Caritas Bianchi College of Careers
Access Provided by:
SILVERCHAIR INFORMATION/SYSTEMS

Chapter 3: Examination and Evaluation of the Patient with a Wound

Rose L. Hamm

INTRODUCTION

CHAPTER OBJECTIVES

At the end of this chapter, the learner will be able to:

1. **Perform a subjective evaluation of a patient with a wound.**
2. **Obtain the pertinent medical and surgical history from a patient or medical record.**
3. **Perform an assessment of wound characteristics.**
4. **Determine the tests and measurements needed to establish a diagnosis and care plan.**
5. **Perform a review of systems for a patient with a wound.**
6. **Establish a wound diagnosis (for the four typical wound) etiologies.**
7. **Determine factors that may be inhibiting wound healing.**
8. **Recognize conditions that warrant immediate medical care and make appropriate referrals.**
9. **Establish goals and outcome measures for a patient with a wound.**

The evaluation of a patient is designed to answer two primary questions: (1) Why does this patient have a wound? and (2) Why is the wound not healing? Answering these questions demands more than a wound assessment, although that is an integral part of the evaluation. It demands an evaluation of the patient, the medical history, and the four systems (integumentary, cardiopulmonary, neuromuscular, and musculoskeletal). Throughout the entire evaluation and treatment process, if the focus is on the patient and not just the wound, there will be a better understanding of *why*. In addition, the time spent obtaining this information will help develop trust and rapport with the patient, and will provide an opportunity to understand the patient goals. Attention to the patient allows the evaluator to recognize emergent or untreated conditions that warrant referral to either the primary care physician or an emergency care facility. Therefore, the focus of this chapter is on "the whole patient and not just the hole in the patient," a phrase first coined by Carrie Sussman, a pioneer in physical therapy treatment of chronic wounds, but a phrase that has been used universally in the era of modern wound management.

SUBJECTIVE HISTORY

Before the wound is uncovered and observed, there are questions that the evaluator can ask the patient (or care-giver) that are helpful in making a diagnosis and understanding why the wound is not progressing. A suggested list of questions is in **TABLE 3-1** and is intended to serve as a guideline for initiating discussion with the patient. As the interview progresses, the evaluator will have additional and more pertinent questions relative to each individual patient. By the time the subjective history is completed, the evaluator will probably have a strong sense of the problems and is on the way to answering the question, *why?* There will also be an indication of the tests and measurements that are needed to make a definitive diagnosis (eg, laboratory tests, vascular screening, gait analysis, extremity girth).

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

TABLE 3-1

Questions to Include in a Subjective Interview of a Patient with a Wound

- When and how did the wound begin?
- Can any other precipitating event be associated with the onset of the wound?
  - A walk in bare foot
  - A fall
  - A new pair of shoes
  - An insect bite
  - A surgical or invasive procedure
- What kind of treatment has been used?
- What other signs and symptoms are present?
  - Fever
  - Itching
  - Pain
- Describe the pain. Quantify the pain. What alleviates the pain?
- Is the wound improving or regressing?
- What other disease processes are present?
- What medications (with dosages) are being taken?
  - Prescription
  - Herbal
  - Over the counter
- Are there any allergies relevant to the wound?
  - Analgesics
  - Antibiotics
  - Adhesives
  - Latex
- What is the nutritional status?
  - Are you a vegetarian or vegan?
  - What did you have for dinner last night? For breakfast this morning?
- What are the alcohol, tobacco, and drug habits?
- What is the physical activity level?
- What kind of assistive device is required for functional activities?
- What kind of shoes does the patient wear?

If the patient is in an acute care or long-term care facility, a thorough chart review will also provide information that is helpful in directing the subjective interview, in determining the diagnosis, and in identifying the inhibiting factors. Chapter 11, Factors That Impede Wound Healing, provides a detailed discussion of inhibiting factors and includes a chart of laboratory values that are commonly abnormal for the patient with a wound. If, during the subjective evaluation, any of the signs and symptoms listed in **TABLE 3-2** are observed or reported, the patient is advised to see the primary care physician or go to an emergency care facility. After the subjective evaluation is completed, the wound assessment is initiated.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

TABLE 3-2

Signs and Symptoms That Suggest a Patient Be Referred to a Primary Care Physician or an Emergency Care Facility

Sign or Symptom	Suspicious Condition
Erythema, edema, deep pain, hot skin	Necrotizing fasciitis Cellulitis
Shortness of breath Lower extremity edema	Congestive heart failure Renal failure
Chest pain	Acute MI
Rash, itching, edema, shortness of breath	Drug allergy, drug-induced hypersensitivity syndrome
Blisters and pain along a dermatome	Acute onset of herpes zoster
Dark mole with asymmetry, uneven borders, changing color, more than 1 cm in diameter, and evolving	Melanoma
Lower extremity pain that increases with activity or awakens the patient at night	Moderate to severe peripheral arterial disease
Syncope, dizziness	Hypotension, hypoglycemia
Decreased mental status	Hypoglycemia, sepsis, cerebral vascular event
Bleeding that is not controlled by pressure	Arterial leak, high INR, low platelet count
New onset of ecchymosis in a distal extremity	Peripheral arterial occlusion
Erythema, warm skin, pain with weight-bearing in patient with diabetes	Acute Charcot foot
Erythema more than 2 cm beyond the wound border of a diabetic foot ulcer	Infection of the wound
Probe to bone in an exposed wound	Osteomyelitis

WOUND ASSESSMENT

In order to perform a complete wound assessment, good lighting and patient positioning for optimal visualization are recommended. Good patient position includes adequate support for the head and neck, covering for both modesty and comfort, and adequate exposure of the wound for both visualization and access (**FIGURES 3-1** and **3-2**).

FIGURE 3-1

Patient position in out-patient setting Patient with a left upper extremity wound is positioned with head slightly elevated and supported with pillows sufficient to accommodate any kyphosis; lower extremities elevated for edema reduction, access to wounds, and patient comfort; arm is supported on a table at a height that is comfortable for the shoulder. Having the hips and knees slightly bent is advised for older patients who may have low-back and leg pain due to spinal stenosis.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

FIGURE 3-2

Patient position in in-patient setting Patient is positioned on the side for access to a sacral wound. A pillow between the legs prevents medial knee pressure and aligns the sacrum/low back for comfort. The patient is draped for warmth and for modesty.

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Although the initial appearance of the wound and periwound skin is observed, the wound assessment is best completed after the wound is cleansed thoroughly with normal saline or sterile water and the wound base is exposed. The following substances are *not* advised for cleansing wounds, especially if there is exposed healthy tissue as in a traumatic injury:

- Hydrogen peroxide (H_2O_2): While diluted H_2O_2 may be useful for removing particulate debris, recent coagulum, and dried blood or debris at the wound edge, undiluted H_2O_2 is cytotoxic to clean or granulating tissue.
- Ionic soaps and detergents: These cleansers (eg, pHisohex) can irritate tissue and increase the potential for infection if used on the wound surface.
- Iodine: 1% iodine is associated with decreased wound healing and has not been shown to decrease the risk of infection over normal saline (when cleansing a new, traumatic wound); concentrated iodine is cytotoxic.[1]

After cleansing, the wound and integumentary assessment includes location, size, tissue type, drainage, periwound skin color, edema, edges, odor, signs of infection, and pain. A standardized assessment tool such as the one developed by Barbara Bates-Jensen can be helpful in guiding the clinician through the assessment process and provides an objective total score and subsequent outcome measures as the wound healing progresses, or can give an indication that the wound is deteriorating (**TABLE 3-3**).[2]

TABLE 3-3

Bates-Jensen Wound Assessment Tool

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Instructions for use

General Guidelines:

Fill out the attached rating sheet to assess a wound's status after reading the definitions and methods of assessment described below. Evaluate once a week and whenever a change occurs in the wound. Rate according to each item by picking the response that best describes the wound and entering that score in the item score column for the appropriate date. When you have rated the wound on all items, determine the total score by adding together the 13-item scores. The HIGHER the total score, the more severe the wound status. Plot total score on the Wound Status Continuum to determine progress. If the wound has healed/resolved, score items 1, 2, 3 and 4 as = 0.

Specific Instructions:

1. **Size**: Use ruler to measure the longest and widest aspect of the wound surface in centimeters; multiply length x width. Score as = 0 if wound healed/resolved.

2. **Depth**: Pick the depth, thickness, most appropriate to the wound using these additional descriptions, score as = 0 if wound healed/resolved:
   - 1 = tissues damaged but no break in skin surface.
   - 2 = superficial, abrasion, blister or shallow crater. Even with, &/or elevated above skin surface (e.g., hyperplasia).
   - 3 = deep crater with or without undermining of adjacent tissue.
   - 4 = visualization of tissue layers not possible due to necrosis.
   - 5 = supporting structures include tendon, joint capsule.

3. **Edges**: Score as = 0 if wound healed/resolved. Use this guide:

Indistinct, diffuse	=	unable to clearly distinguish wound outline.
Attached	=	even or flush with wound base, no sides or walls present; flat.
Not attached	=	sides or walls are present; floor or base of wound is deeper than edge.
Rolled under, thickened	=	soft to firm and flexible to touch.
Hyperkeratosis	=	callous-like tissue formation around wound & at edges.
Fibrotic, scarred	=	hard, rigid to touch.

4. **Undermining**: Score as = 0 if wound healed/resolved. Assess by inserting a cotton tipped applicator under the wound edge; advance it as far as it will go without using undue force; raise the tip of the applicator so it may be seen or felt on the surface of the skin; mark the surface with a pen; measure the distance from the mark on the skin to the edge of the wound. Continue process around the wound. Then use a transparent metric measuring guide with concentric circles divided into 4 (25%) pie-shaped quadrants to help determine percent of wound involved.

© 2006 Barbara Bates-Jensen

5. **Necrotic Tissue Type**: Pick the type of necrotic tissue that is predominant in the wound according to color, consistency and adherence using this guide:

White/gray non-viable tissue	=	may appear prior to wound opening; skin surface is white or gray.
Non-adherent, yellow slough	=	thin, mucinous substance; scattered throughout wound bed; easily separated from wound tissue.
Loosely adherent, yellow slough	=	thick, stringy, clumps of debris; attached to wound tissue.
Adherent, soft, black eschar	=	soggy tissue; strongly attached to tissue in center or base of wound.
Firmly adherent, hard/black eschar	=	firm, crusty tissue; strongly attached to wound base and edges (like a hard scab).

6. **Necrotic Tissue Amount**: Use a transparent metric measuring guide with concentric circles divided into 4 (25%) pie-shaped quadrants to help determine percent of wound involved.

7. **Exudate Type**: Some dressings interact with wound drainage to produce a gel or trap liquid. Before assessing exudate type, gently cleanse wound with normal saline or water. Pick the exudate type that is predominant in the wound according to color and consistency, using this guide:

Bloody	=	thin, bright red
Serosanguineous	=	thin, watery pale red to pink
Serous	=	thin, watery, clear
Purulent	=	thin or thick, opaque tan to yellow or green may have offensive odor

8. **Exudate Amount**: Use a transparent metric measuring guide with concentric circles divided into 4 (25%) pie-shaped quadrants to determine percent of dressing involved with exudate. Use this guide:

None	=	wound tissues dry.
Scant	=	wound tissues moist; no measurable exudate.
Small	=	wound tissues wet; moisture evenly distributed in wound; drainage involves ≤25% dressing.
Moderate	=	wound tissues saturated; drainage may or may not be evenly distributed in wound; drainage involves >25% to ≤75% dressing.
Large	=	wound tissues bathed in fluid; drainage freely expressed; may or may not be evenly distributed in wound; drainage involves >75% of dressing.

9. **Skin Color Surrounding Wound**: Assess tissues within 4cm of wound edge. Dark-skinned persons show the colors "bright red" and "dark red" as a deepening of normal ethnic skin color or a purple hue. As healing occurs in dark-skinned persons, the new skin is pink and may never darken.

10. **Peripheral Tissue Edema & Induration**: Assess tissues within 4cm of wound edge. Non-pitting edema appears as skin that is shiny and taut. Identify pitting edema by firmly pressing a finger down into the tissues and waiting for 5 seconds, on release of pressure, tissues fail to resume previous position and an indentation appears. Induration is abnormal firmness of tissues with margins. Assess by gently pinching the tissues. Induration results in an inability to pinch the tissues. Use a transparent metric measuring guide to determine how far edema or induration extends beyond wound.

11. **Granulation Tissue**: Granulation tissue is the growth of small blood vessels and connective tissue to fill in full thickness wounds. Tissue is healthy when bright, beefy red, shiny and granular with a velvety appearance. Poor vascular supply appears as pale pink or blanched to dull, dusky red color.

12. **Epithelialization**: Epithelialization is the process of epidermal resurfacing and appears as pink or red skin. In partial thickness wounds it can occur throughout the wound bed as well as from the wound edges. In full thickness wounds it occurs from the edges only. Use a transparent metric measuring guide with concentric circles divided into 4 (25%) pie-shaped quadrants to help determine percent of wound involved and to measure the distance the epithelial tissue extends into the wound.

© 2006 Barbara Bates-Jensen

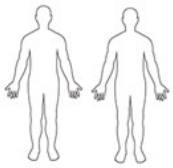
Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

BATES-JENSEN WOUND ASSESSMENT TOOL NAME

Complete the rating sheet to assess wound status. Evaluate each item by picking the response that best describes the wound and entering the score in the item score column for the appropriate date. If the wound has healed/resolved, score items 1, 2, 3, & 4 as = 0.

Location: Anatomic site. Circle, identify right **(R)** or left **(L)** and use **"X"** to mark site on body diagrams:

—— Sacrum & coccyx
—— Trochanter
—— Ischial tuberosity
—— Buttock
—— Lateral ankle
—— Medial ankle
—— Heel
—— Other site: _____.



Shape: Overall wound pattern; assess by observing perimeter and depth.

Circle and date appropriate description:

—— Irregular
—— Round/oval
—— Square/rectangle
—— Linear or elongated
—— Bowl/boat
—— Butterfly
Other Shape

Item	Assessment	Date Score	Date Score	Date Score
1. Size*	*0 = Healed, resolved wound 1 = Length × width <4 sq cm 2 = Length × width 4 to ≤16 sq cm 3 = Length × width 16.1 to ≤36 sq cm 4 = Length × width 36.1 to ≤80 sq cm 5 = Length × width >80 sq cm			
2. Depth*	*0 = Healed, resolved wound 1 = Non-blanchable erythema on intact skin 2 = Partial thickness skin loss involving epidermis &/or dermis 3 = Full thickness skin loss involving damage or necrosis of subcutaneous tissue; may extend down to but not through underlying fascia; &/or mixed partial & full thickness &/or tissue layers obscured by granulation tissue 4 = Obscured by necrosis 5 = Full thickness skin loss with extensive destruction, tissue necrosis or damage to muscle, bone or supporting structures			
3. Edges*	*0 = Healed, resolved wound 1 = Indistinct, diffuse, none clearly visible 2 = Distinct, outline clearly visible, attached, even with wound base 3 = Well-defined, not attached to wound base 4 = Well-defined, not attached to base, rolled under, thickened 5 = Well-defined, fibrotic, scarred or hyperkeratotic			
4. Under-mining*	*0 = Healed, resolved wound 1 = None present 2 = Undermining <2 cm in any area 3 = Undermining 2–4 cm involving <50% wound margins 4 = Undermining 2–4 cm involving >50% wound margins 5 = Undermining >4 cm or Tunneling in any area			
5. Necrotic Tissue Type	1 = None visible 2 = White/gray non-viable tissue &/or non-adherent yellow slough 3 = Loosely adherent yellow slough 4 = Adherent, soft, black eschar 5 = Firmly adherent, hard, black eschar			
6. Necrotic Tissue Amount	1 = None visible 2 = <25% of wound bed covered 3 = 25% to 50% of wound covered 4 = >50% and <75% of wound covered 5 = 75% to 100% of wound covered			

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Item	Assessment	Date Score	Date Score	Date Score
7. Exudate Type	1 = None 2 = Bloody 3 = Serosanguineous: thin, watery, pale red/pink 4 = Serous: thin, watery, clear 5 = Purulent: thin or thick, opaque, tan/yellow, with or without odor			
8. Exudate Amount	1 = None, dry wound 2 = Scant, wound moist but no observable exudate 3 = Small 4 = Moderate 5 = Large			
9. Skin Color Surrounding Wound	1 = Pink or normal for ethnic group 2 = Bright red &/or blanches to touch 3 = White or gray pallor or hypopigmented 4 = Dark red or purple &/or non-blanchable 5 = Black or hyperpigmented			
10. Peripheral Tissue Edema	1 = No swelling or edema 2 = Non-pitting edema extends <4 cm around wound 3 = Non-pitting edema extends >4 cm around wound 4 = Pitting edema extends <4 cm around wound 5 = Crepitus and/or pitting edema extends >4 cm around wound			
11. Peripheral Tissue Induration	1 = None present 2 = Induration <2 cm around wound 3 = Induration 2–4 cm extending <50% around wound 4 = Induration 2–4 cm extending >50% around wound 5 = Induration >4 cm in any area around wound			
12. Granulation Tissue	1 = Skin intact or partial thickness wound 2 = Bright, beefy red; 75% to 100% of wound filled &/or tissue overgrowth 3 = Bright, beefy red; <75% & >25% of wound filled 4 = Pink, &/or dull, dusky red &/or fills ≤25% of wound 5 = No granulation tissue present			
13. Epithelialization	1 = 100% wound covered, surface intact 2 = 75% to <100% wound covered &/or epithelial tissue extends >0.5 cm into wound bed 3 = 50% to <75% wound covered &/or epithelial tissue extends to <0.5 cm into wound bed 4 = 25% to <50% wound covered 5 = <25% wound covered			
	TOTAL SCORE			
	SIGNATURE			

WOUND STATUS CONTINUUM

1 5 9 13 15 20 25 30 35 40 45 50 55 65

Tissue Health — Healed — Wound Regeneration — Wound Degeneration

Plot the total score on the Wound Status Continuum by putting an "X" on the line and the date beneath the line. Plot multiple scores with their dates to see-at-a-glance regeneration or degeneration of the wound.

© 2006 Barbara Bates-Jensen

The Pressure Ulcer Scale for Healing (PUSH©), developed by the National Pressure Ulcer Advisory Panel to measure progress or regression in pressure ulcers, grades a wound based on length, width, exudate amount, and tissue type.[3] These parameters are based on the Centers for Medicare and Medicaid Services (CMS) definition of wound progress: a decrease in area or volume, amount of exudate, and amount of necrotic tissue.[4] The study by Hon et al. found the PUSH© to be responsive to wound progress in pressure, venous, and diabetic ulcers; however, it is more sensitive in larger wounds than in smaller wounds in the last stages of healing.[4] The PUSH© tool has also been found to be responsive to burns and scalds, skin tears, surgical wounds, and traumatic wounds.[5]

The Wound Healing Index (WHI) was developed to stratify patients with wounds according to the wound characteristics and underlying conditions that affect wound healing, and thus validly predict likelihood of wound healing.[6] The WHI could then be used to stratify patients for random controlled trials and to identify patients early in treatment who would benefit from advanced therapies. Those variables that were identified as significant for patients with wounds of all types include the following: wound size, wound age, number of wounds of any etiology, evidence of bioburden, type of tissue exposed (eg, using Wagner scale or PU staging), being non-ambulatory, and requiring hospitalization in the course of treatment.[6] Further studies have identified additional significant variables for diabetic foot ulcers (patient age, renal dialysis, and peripheral vascular disease[7]) and for pressure ulcers on any body area except the heel (PU Stage III or IV, patient age, having renal transplant, paralysis, malnutrition, and patient hospitalization for any reason[8]).

Chronic wounds are known to have a significant impact on patient quality of life,[9] and assessing that impact is an important part of the initial evaluation, not only for understanding the patient emotional and functional status, but also for helping to set reasonable and meaningful goals. Several tools that have been developed to assess quality of life include the following: Freiburg Life Quality Assessment[10,11] (has a short version adapted for venous disease and lymphedema), Wound-QoL questionnaire,[12,13] the Cardiff Wound Impact Schedule,[14] and the Wurzburg Wound Score for lower extremity arterial and vascular wounds.[15]

TABLE 3-4 provides a list of assessment tools intended to help the evaluator create an accurate picture of the wound status, assess pain associated with the wound, assess patient-reported quality of life issues, develop an effective and appropriate care plan, and document objectively the progression or regression of a wound.[16] The literature provides several comparisons of the various tools used to assess wounds and/or predict risk for pressure ulcer development and the clinician is advised to

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

select one that is most appropriate for the patient population being served.[17–20] Use of these assessment tools as applicable to each patient is highly recommended for determining efficacy of interventions and reporting progress to third-party payers.

TABLE 3-4

Assessment Tools for Objective Wound Documentation

Name of Tool	Purpose of Tool	Electronic Access
WOUND ASSESSMENT		
Bates–Jensen Wound Assessment Tool (BWAT)	Assess wounds of all types, monitor wound healing	http://www.geronet.med.ucla.edu/centers/borun/modules/Pressure_ulcer_prevention/puBWAT.pdf
Braden Scale	Assess risk of pressure ulcer formation	https://www.in.gov/isdh/files/Braden_Scale.pdf
DESIGN-Rating	Score the severity of Pus and to monitor healing, based on Depth, Exudates, Size, Inflammation/infection, Granulation tissue, and Necrotic tissue	http://www.jspu.org/eng/special_1.html
Glamorgan Pressure Injury Risk Assessment	Assess risk of pressure injury in pediatric patients	https://www.rch.org.au/uploadedFiles/Main/Content/rchcpg/Revised_Glamorgan_Reference_Guide.pdf
Gosnell Scale	Assess risk of pressure ulcer formation	https://answers.yahoo.com/question/index?qid=1006032101152
Healing Progression Rate Tool	Assess wound healing specifically for PUs, using the current NPUAP definitions and descriptions	Young DL, Estocado N, Feng D, Black J. The development and preliminary validity testing of the Healing Progression Rate Tool. *Ostomy Wound Management.* 2017;63(9):32–44. Available at: doi:10.25270/owm.2017.09.3244.
Long Beach Wound Scores	Scores severity of wounds, especially DFUs, based on size, tissue appearance, depth, infection, and perfusion	https://www.woundsresearch.com/article/reliability-assessment-innovative-wound-score
Norton Scale	Assess risk of pressure ulcer formation	http://education.woundcarestrategies.com/coloplast/resources/NortonScale.pdf
OPTIMAL	Assess patient perception of difficulty and confidence in performing mobility tasks. Helps determine	http://www.apta.org/optimal/

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

	effect of wound on patient function	
Photographic Wound Assessment Tool (PWAT); adapted from BWAT	Assess wounds by interpretation of photographs (eg, in telemedicine or electronic consultation)	http://www.southwesthealthline.ca/healthlibrary_docs/B.9.3b.PWATInstruc.pdf
Pressure Ulcer Scale for Healing (PUSH)	Assess pressure ulcer healing in long-term care settings; developed by the NPUAP	http://www.npuap.org/wp-content/uploads/2012/02/push3.pdf
SCI-Pressure Ulcer Monitoring Tool	Assess pressure ulcer healing in patients with spinal cord injury	https://www.queri.research.va.gov/tools/sci-pumt/
Sessing Scale	Assess pressure ulcer healing or degression	http://www.ncbi.nlm.nih.gov/pubmed/7806737 https://www.bing.com/images/search?view=detailV2&ccid=WJBD2%2fpY&id=0
Sussman Wound Healing Tool (SWHT)[3]	Assess pressure ulcer healing and efficacy of interventions; may be used for wounds of all types	Not available online Bates-Jensen BM, Sussman C. Tools to measure wound healing. In: Bates-Jensen BM, Sussman C, eds. *Wound Care: A Collaborative Practice Manual for Health Care Professionals.* Baltimore, MD: Lippincott Williams & Wilkins; 2012:131–161.
Visual Analog Pain Assessment Scale (VAS)	Assess pain intensity on a scale of 1–10	http://img.medscape.com/article/742/580/VAS.pdf
Waterlow score	Assess risk of pressure ulcer formation	http://www.judy-waterlow.co.uk/downloads/Waterlow%20Score%20Card-front.pdf
Wound Healing Index	Identify patient and wound factors that affect likelihood of wound healing	Horn SD, Fife CE, Smout RJ, Barrett RS, Thomson B. Development of a wound healing index for patients with chronic wounds. *Wound Repair and Regeneration.* 2013;21:823–832.
Wound Trend Scale	Assesses lower leg wound management, includes screening for infection and cues for physician referral	Campbell NA, Campbell DL, Turner A. The Wound Trend Scale: A retrospective review of utility and predictive value in the assessment and documentation of lower leg ulcers. *Ostomy Wound Management.* 2016;62(12):40–53. https://www.divisionsbc.ca/CMSMedia/Divisions/DivisionCatalog-victoria/Dine%20and%20learn%20presentations/2014.01.28%20Foot%20and%20leg%20ulcer%20mgmt/WTS%20WMC2010%20form.pdf
PAIN ASSESSMENT		
Faces Pain Scale (Wong Baker)	Assess pain intensity on a scale of 0–5 based on identification with facial expressions	http://www.pediatricnursing.net/interestarticles/1401_Wong.pdf
FLACC	Assess pain in children	http://wps.prenhall.com/wps/media/objects/3103/3178396/tools/flacc.pdf

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Behavior Pain Assessment Scale (Face, Legs, Activity, Cry, Consolability)	from newborn to age 3	
NOPPAIN (Non-communicative Patient's Pain Assessment Instrument)	Assess pain in non-communicative patients	http://prc.coh.org/PainNOA/NOPPAIN_Tool.pdf
PAINAD	Assess pain in patients unable to verbalize intensity (eg, advanced Alzheimer or comatose patients). Uses nonverbal behaviors in response to painful stimuli	http://geriatrictoolkit.missouri.edu/cog/painad.pdf
Visual Analog Pain Assessment Scale (VAS)	Assess pain intensity on a scale of 1–10	http://img.medscape.com/article/742/580/VAS.pdf
QUALITY OF LIFE ASSESSMENT		
Cardiff Wound Impact Questionnaire	Assess patient-reported impact of chronic wounds on quality of life and identify patient concerns	http://www.southwesthealthline.ca/healthlibrary_docs/B.4.2.CardiffWoundImpactQuest.pdf
Freiburg Life Quality Assessment	Assess effect of chronic wounds on patient quality of life; also adapted for patients with lymphedema	https://www.ncbi.nlm.nih.gov/pubmed/15197001
Wound QoL Questionnaire	Assess the effect of chronic wounds on patient quality of life	https://www.daemen.edu/sites/default/files/Wound-Outcome-Measure-Questionnaire.pdf
Wuerzburg Wound Score	Assess quality of life effects of lower extremity arterial and venous wounds	https://www.doi.1024/0301-1526/a000378

Location

Location is an important component of determining the wound etiology. **TABLE 3-5** provides a summary of the characteristics of the four typical wound etiologies (arterial, venous, pressure, and neuropathic) and the location differences that are a significant aspect of determining the wound etiology. Location is described by

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

anatomical body part, using medical terms to define specifics (**FIGURES 3-3** to **3-6**).

FIGURE 3-3

Location of wound on sacrum Wounds are located on (**A**) left gluteal region, (**B**) left sacral area, and (**C**) right superior gluteal region.

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

FIGURE 3-4

Location of wound on the hand Wound located on the lateral dorsal aspect of the right hand, including the web space, 2nd and 3rd proximal phalanxes.

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

FIGURE 3-5

Location of wound on lower extremity Wound located on the gaiter (or distal 1/3) area of the right lateral leg.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

FIGURE 3-6

Location of wound on dorsal foot Wound located on the dorsal proximal interphalangeal joint of the right second toe.

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

TABLE 3-5

Characteristics of the Four Typical Wound Etiologies

WOUND EVALUATION BY ETIOLOGY					
	Location	**Tissue**	**Pain**	**Skin**	**Exudate**
Arterial	Distal digits (toes or fingers)	Dry, necrotic or slough, little or no granulation	Yes!!! May have dependent leg syndrome or rest pain	Dry, hairless, shiny, thin, positive rubor of dependency	None unless infected
Venous	Lower 1/3 of the leg (called the gaiter area)	Red or pink, bark texture, yellow sloughPoor granulation	Generally not painful unless vasculitic or infected	Hemosiderous (dark, brawny appearance)Atrophie blanche	Varies, may have copious serous drainage
Pressure	Over bony prominences	Varies from non-blanchable erythema to dark red to eschar	Varies depending on the structures involved	Discolored from erythematous to hypoxic may be macerated or excoriated	Varies
Neuropathic	Weight-bearing surface of the foot or dorsal digits	Callus or blister, slough, may probe to bone, necrotic with PAD	None!!! Until infected, then deep throbbing	Dry, thick, scaly, hyperkeratotic	Varies, depending on infection

Developed by Rose Hamm, used with permission.

Dimensions

Wound size is a major outcome measurement and is used to document improvement or lack of response to interventions, or to predict healing potential.[21,22] For example, diabetic foot wounds that decrease in size during the first 4–6 weeks of healing are more likely to have full closure.[23] Periodic measurements give objective feedback about the efficacy of treatment and serve as indicators as to when interventions need to be changed due to lack of tissue response. Wound dimensions are also one of the primary indicators used by third-party payers to determine treatment efficacy. Wound surface area can be calculated in several different ways; however, electronic assessment is the only method that is absolute.

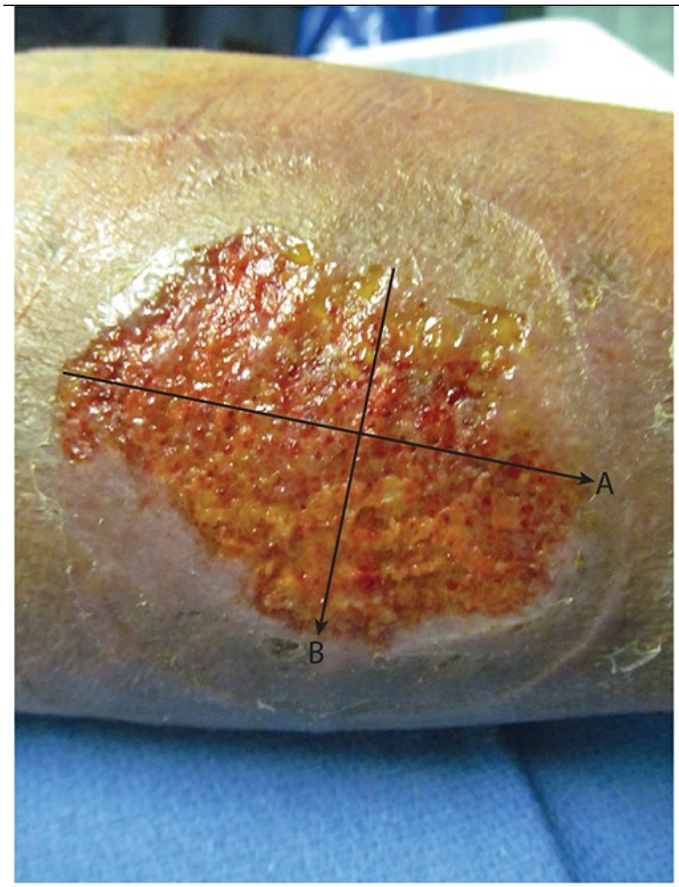
Perpendicular Method

The perpendicular (or ruler) method measures the wound length at its longest dimension and the width at the longest dimension perpendicular to the length (**FIGURE 3-7**). Measurements are recorded in either centimeters (cm) or millimeters (mm), and can be multiplied for a surface area (A = length × width), although it would be approximate because wounds are rarely shaped like a rectangle. Elliptical surface area can also be calculated [A = (π × length × width)/4].[24] Volume can also be calculated with the ruler method (V = length × width × depth); the depth is measured with a sterile applicator perpendicular from the deepest area to the wound surface. The perpendicular method has been shown to have good reliability in wounds <4 cm^2,[25] and it is quick, easy, and inexpensive; however, it has the disadvantage of over-estimating wound surface area.[24,26]

FIGURE 3-7

Perpendicular method The perpendicular method measures the wound at the longest dimension (**A**) as the length, and the longest dimension perpendicular to the length (**B**) as the width.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility



Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

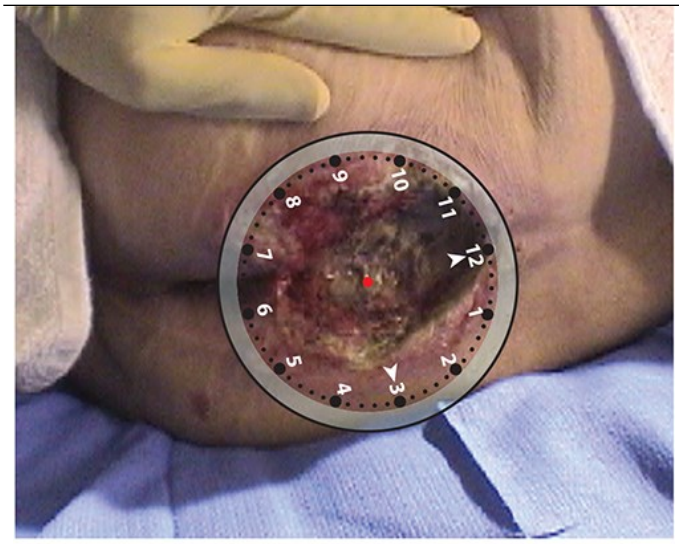
Clock Method

The clock method imagines a clock super-imposed on the wound with 12:00 placed cephalically and 6:00 placed caudally. Measurements are then taken at any direction on the clock and documented (eg, 6 cm at 12–6:00 and 2 cm at 3–9:00) (**FIGURE 3-8**). When using the clock method, which is beneficial for sacral ulcers, the position of the patient is also documented in order to have consistency of wound configuration between measurements. For example, if a patient is positioned in right side lying for measurements at the time of initial evaluation and in left side lying 1 week later for reassessment, the wound will have a different orientation and configuration, and measurements may not be as valid. The clock method is also helpful in describing wound landmarks (eg, undermining and sinuses) as illustrated in **FIGURE 3-9**.

FIGURE 3-8

Clock method for wound surface area The clock method is useful for aligning wounds with anatomical position in which 12:00 is cephalic and 6:00 is caudal, 3:00 is right lateral, and 9:00 is left lateral.

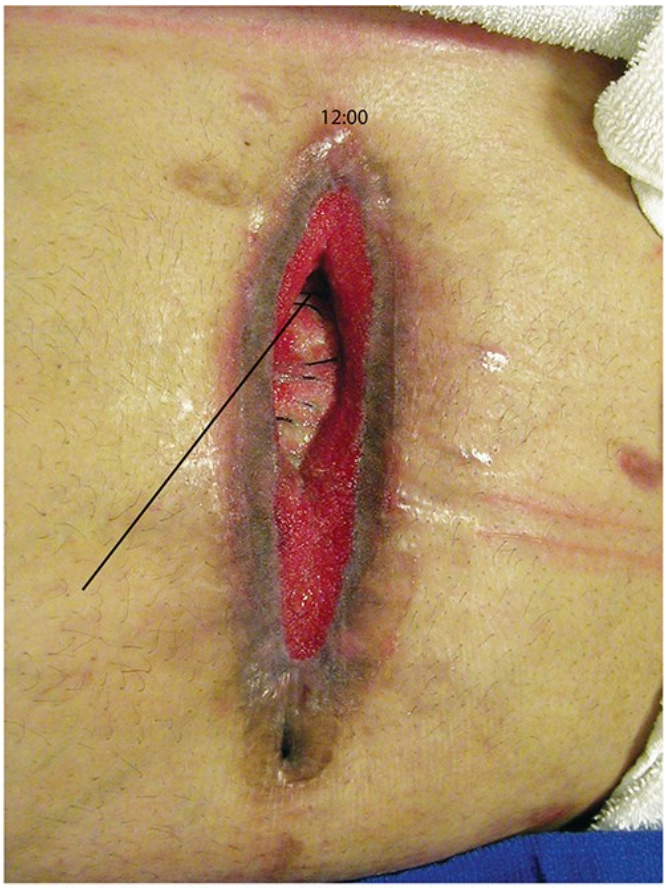
Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility



Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

FIGURE 3-9

Clock method for location of sinus or undermining This incisional abdominal wound has a sinus at 12:00 or the superior aspect.



Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Tracing

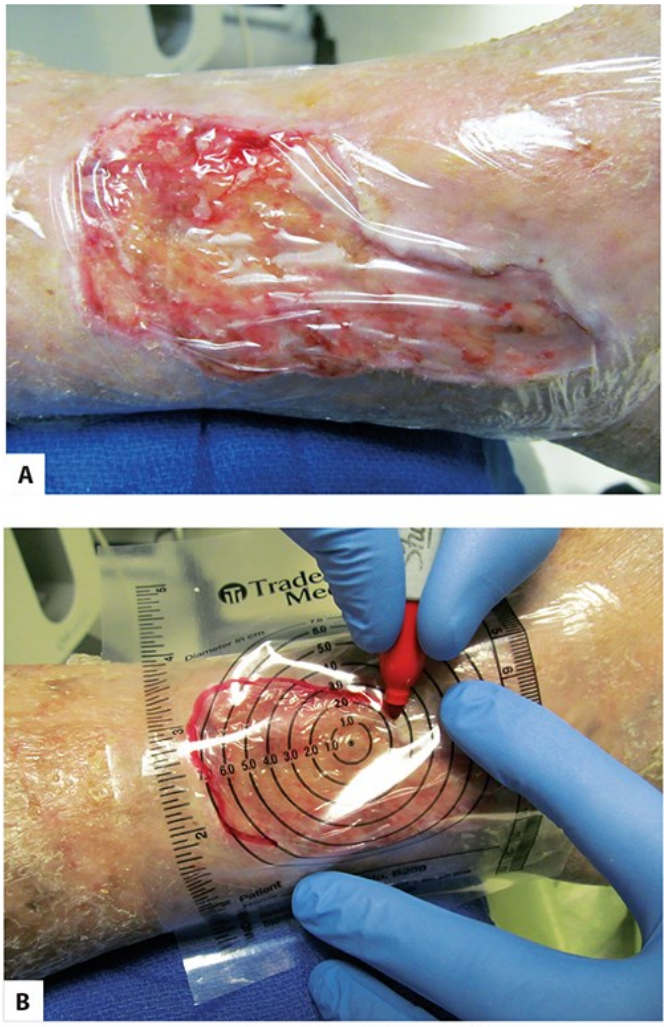
Tracing uses a clear plastic measuring guide over the wound to trace the edges and is useful for wounds that have serpentine or uneven edges (**FIGURE 3-10A, B**). A clear

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

film is placed over the wound first, and then the measuring guide, and the wound is traced with a permanent marking pen. Some guides have 1-cm grids that can be used to calculate surface area by counting the number of cross-sections or the number of blocks within the wound tracing.[24,27] Tracing has also been combined with planimetry software to determine more accurate wound surface: the wound is manually traced, scanned into computer software, and exact surface area calculated.[24,28] The disadvantages of wound tracing are the following: sinuses, undermining, and depth are not measured; discomfort to the patient with pressure on the wound; risk of contamination; and edges can be obscured if there is moisture under the film.[29]

FIGURE 3-10

Tracing a wound A. Before placing the tracing guide on the wound, a clear plastic film is placed on the wound to prevent wound fluids and possible infection from being transferred to the patient chart. **B.** The tracing guide is placed over the first layer of plastic film and the wound is traced with an indelible marking pen. Tracing is recommended for serpentine wounds that do not have well-defined lengths and widths to measure.



Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Photography

Digital photography has become the standard for wound photography due to its availability and its ability to be downloaded into electronic medical records. High resolution allows excellent visualization of wound characteristics. **TABLE 3-6** lists some recommendations for achieving optimal results when using digital cameras. Some photographs also have the 1-cm grid described above to assist in calculating surface area.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

TABLE 3-6

Guidelines for Obtaining Optimal Results When Taking Digital Photographs

- Position the patient so that the wound can be easily visualized in the viewbox.
- Center the wound in the viewbox.
- Adjust the lighting for equal illumination in order to eliminate shadows.
- Use blue or green towels around the wound to eliminate busy backgrounds and other features that may identify the patient, and to absorb light and prevent reflecting light waves that may wash out the wound color.
- Close curtains or shades so that only fluorescent light exists in the room; this also minimizes glare.
- Hold the camera at a 90-degree angle to the wound bed to avoid distortion of the shape.
- Set the camera on "Macro" to get sharper definition of wound characteristics.
- Take more than one photograph at different settings.
- Label the photograph with a statement that it has not been altered from original shot. This is important documentation in the case of litigation.

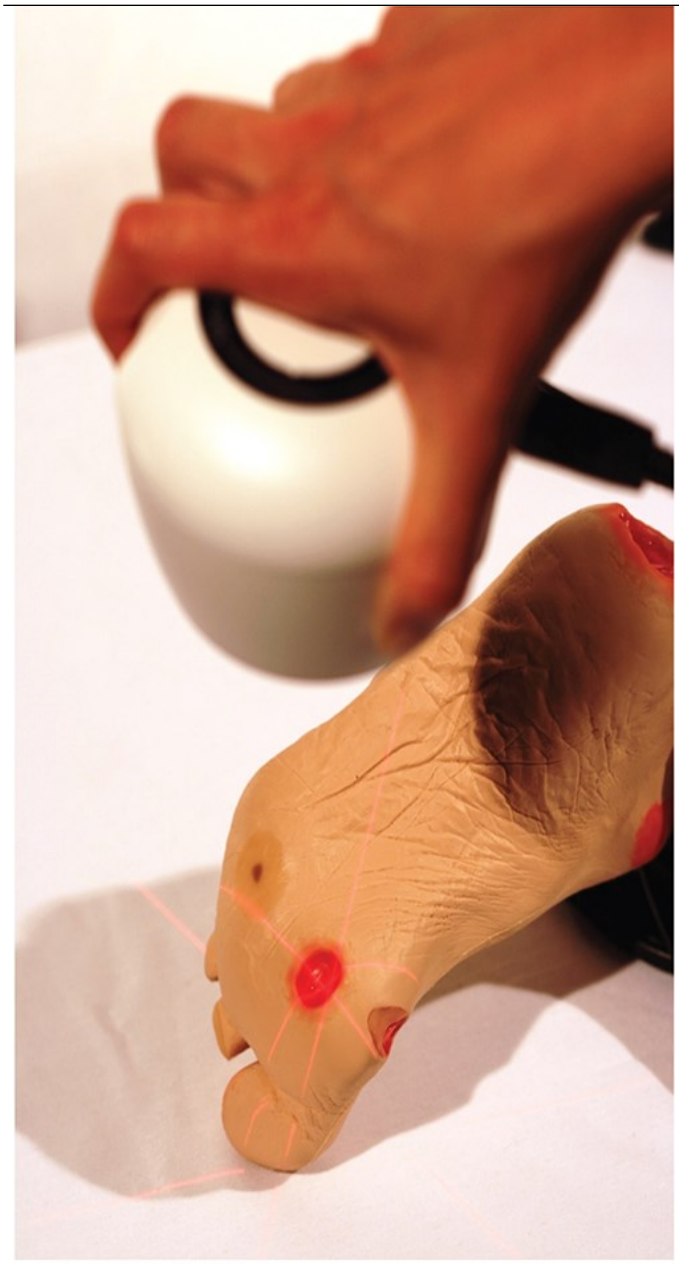
Planimetry

Planimetry uses software to calculate dimensions from digital photography and has become the standard method for recording data for wound research. Results of surface area have been shown to be more accurate with planimetry, especially with wounds over 4 cm^2.[16] Digital photographs are downloaded into the computer and software used to calculate dimensions, surface area, estimated volume, circumference, and in some cases, tissue type based on color analysis. Another type of planimetry involves the use of a digital camera that uses laser beams to ensure accurate focus on the wound, attachment from the camera to a personal computer, and software that allows the clinician to trace the wound bed and calculate the surface area.[30] (See **FIGURE 3-11.**) Planimetry has been shown to be the most accurate method for calculating wound measurements[25,31–33]; however, using the same system throughout the healing process is required for consistency and accuracy.

FIGURE 3-11

Wound being photographed with Silhouette (point-of-care imaging device) The wound imaging, measuring, and documentation system uses laser intersections to focus the camera on the wound bed; transfers the image to computer software; and measures the surface area, depth, and volume electronically. The intersections of the laser lines on the wound are aligned so that they cross at the center of the wound, indicating the best focus and most accurate measuring. (Used with permission from ARANZ Medical Limited, New Zealand.)

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility



Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Subcutaneous Extensions

Some wounds, especially pressure, diabetic foot, and surgical wounds, tend to have necrotic subcutaneous tissue that prevents the wound edge from adhering to the wound bed. The author terms these *subcutaneous extensions* because the actual wound extends beneath the visible epithelial edge. Examples include undermining, sinuses, tunnels, and fistulas. Because the presence of subcutaneous extensions may be an indication of underlying infection or lead to deeper abscesses, documentation of measurement (in depth) and location (using the clock method of anatomic position) is an essential part of the wound assessment.[3,34] Treatment plans need to include debridement, cleansing, and dressing application to subcutaneous extensions, as well as the visible wound bed.

Undermining is a result of necrotic hypodermal connective tissue that disrupts the attachment of the skin to the underlying structures. Dark discolored skin around the visible periphery of the wound may be an indication of undermining and is explored with a sterile instrument to determine the extent. Documentation includes the depth at the deepest point and the extent using the clock orientation (**FIGURE 3-12A, B**).

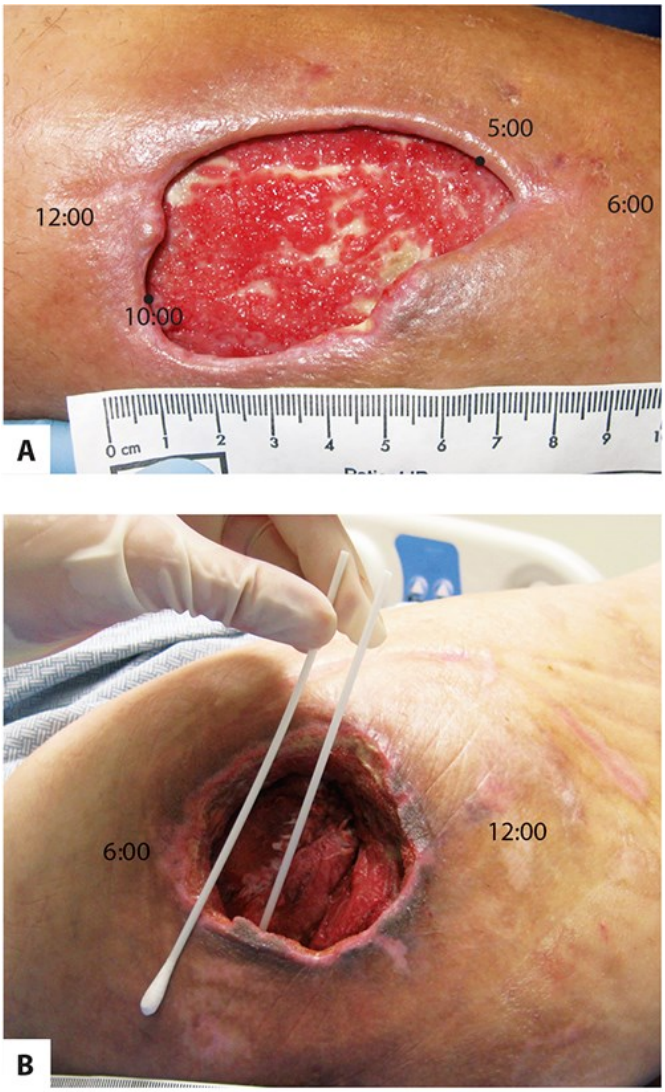
Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

CLINICAL CONSIDERATION

Probing is best accomplished with a calcium alginate-tipped applicator as fibers left in the wound are biodegradable and will not lead to granuloma formation. If these applicators are not available, cotton-tipped applicators may be used; moistening the tip with normal saline or sterile water will help prevent the loss of cotton fibers in the deeper wound bed. Sterile metal instruments are advised if the evaluator is probing for possible bone exposure.

FIGURE 3-12

Undermining A. The shadow that extends across the left and upper borders of the wound indicates undermining where the skin is detached from the underlying structure, usually a result of autolysis of the subcutaneous tissue. The depth of undermining would be recorded, for example, as 3–5 mm from 10:00 to 5:00. **B.** Undermining is being measured in the pressure wound on a greater trochanter. The applicator on the outside indicates the depth of the undermining, which would be documented, for example, as 3.5 cm at 4:00.



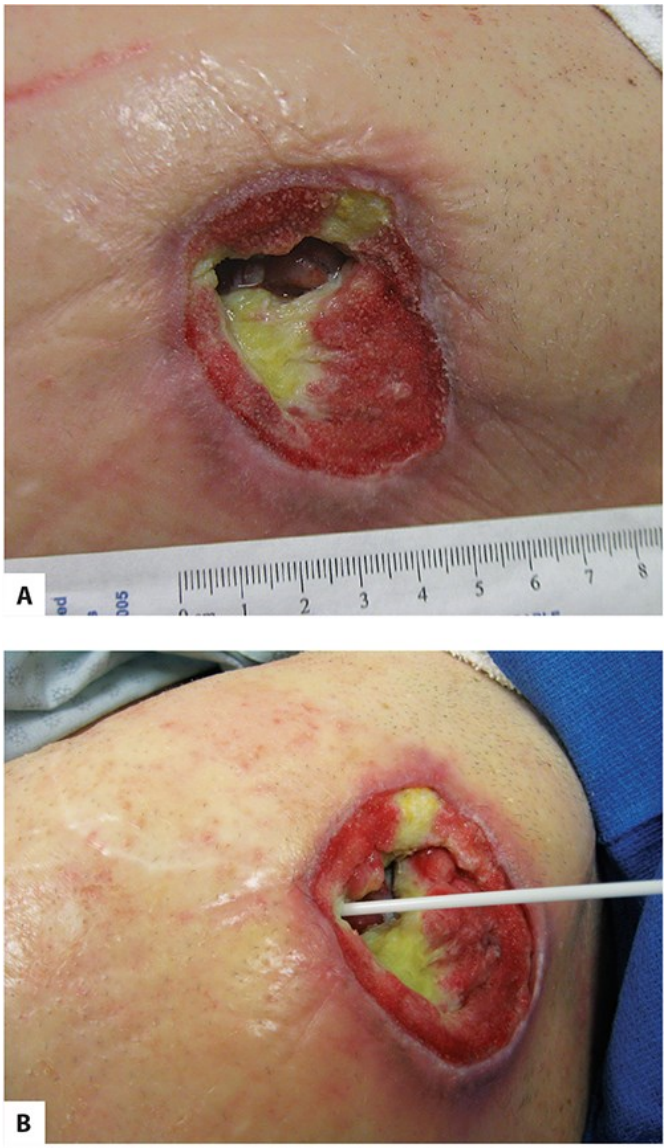
Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Sinuses are extensions that run along a fascial plane and usually have a small opening that connects to a deeper area of tissue loss. Sinuses may contain fluid trapped in the deeper area, and may lead to abscess formation if not explored and cleansed thoroughly. Suspicion of a sinus is indicated by observation of a dark area at the edge of a wound and warrants exploration. Depth is measured with a sterile alginate-tipped applicator and location recorded using the clock orientation (**FIGURE 3-13A, B**).

FIGURE 3-13

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Sinus A sinus or fascial track is indicated by the dark opening in the visible wound bed in photo **A.** In photo **B,** the sinus is being explored with a sterile applicator to determine the depth and possible pockets of fluid.



Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Tunneling occurs when two cutaneous wounds connect (**FIGURE 3-14**). The two cutaneous wounds may initially appear to be two separate wounds, but when probed reveal that the subcutaneous tissue between the openings is necrotic and not connected to the under surface of the skin. In this case, the sizes of the two openings and the length of the tissue loss between the openings are measured and documented.

FIGURE 3-14

Tunneling A tunneling wound has two openings that are connected beneath the skin.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

A *fistula* is defined as an abnormal connection between two epithelium-lined structures where a connection does not usually exist. Sometimes it is created for medical purposes, for example, in the case of an arteriovenous fistula between an upper extremity artery and vein for hemodialysis access. The type most frequently encountered in wound care is an enterocutaneous or enteroatmospheric fistula that connects some part of the digestive system with the skin or wound surface (**FIGURE 3-15**). While the depth of the fistula is not appropriate to measure, the location is a component of the wound assessment. The type of drainage (eg, thin green, thick brown, or solid brown) can indicate the location of the digestive track where the fistula originates.

FIGURE 3-15

Fistula An enterocutaneous fistula is a connection between some part of the gastric system and the skin, often occurring after intestinal resection or gastric surgery. In this photo, the fistula is surrounded by a full-thickness wound, and the drainage that comes from the fistula can be caustic to the skin. When the fistula is surgically created, the everted part of the bowel is termed a *stoma*.

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Tissue Type

Identification of the tissue type within a wound bed is necessary for understanding the phase of healing and for developing a plan of care, especially the optimal type of debridement and dressings. If one observes a structure that cannot be named or identified during the evaluation or treatment procedure, the procedure should be discontinued until research can help identify the tissue of concern. A documentation technique that is helpful in measuring outcomes is to assign a percentage of the total wound surface to each tissue type. While this is approximate at best, especially when using the perpendicular or ruler technique rather than sophisticated software, it does help document improvement in tissue quality as the wound progresses from inflammation to granulation to epithelialization. Normal structures (eg, skin, bone, muscle, tendon, and adipose) may be either viable or non-viable, healthy or not healthy, and are identified as such in the evaluation.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Eschar is non-viable or necrotic tissue that covers all or part of a wound base. It is composed of dead skin or subcutaneous cells and may vary in color (black, brown, gray, yellow, tan) and texture (hard, dry, rubbery, soft). Eschar is not synonymous with what is commonly called a "scab," which is a result of blood and serum hardening over a fresh wound (**FIGURE 3-16**).

FIGURE 3-16

Eschar The wound on the below-knee amputation site contains (**A**) hard dry black eschar and (**B**) softer brown eschar, both consisting of dead or necrotic tissue.

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Slough is non-viable subcutaneous tissue, often found under eschar, and is a result of the body's autolytic process to phagocytose dead cells. The usually soft and yellow substance has no real texture and is hard to grasp with forceps, unlike stringy, fibrous yellow or tan connective tissue that may also be under eschar (**FIGURE 3-17**).

FIGURE 3-17

Slough The soft yellow substance on the wound surface is a result of autolysis of subcutaneous or connective tissue. Slough has no texture and is best removed with a curette.

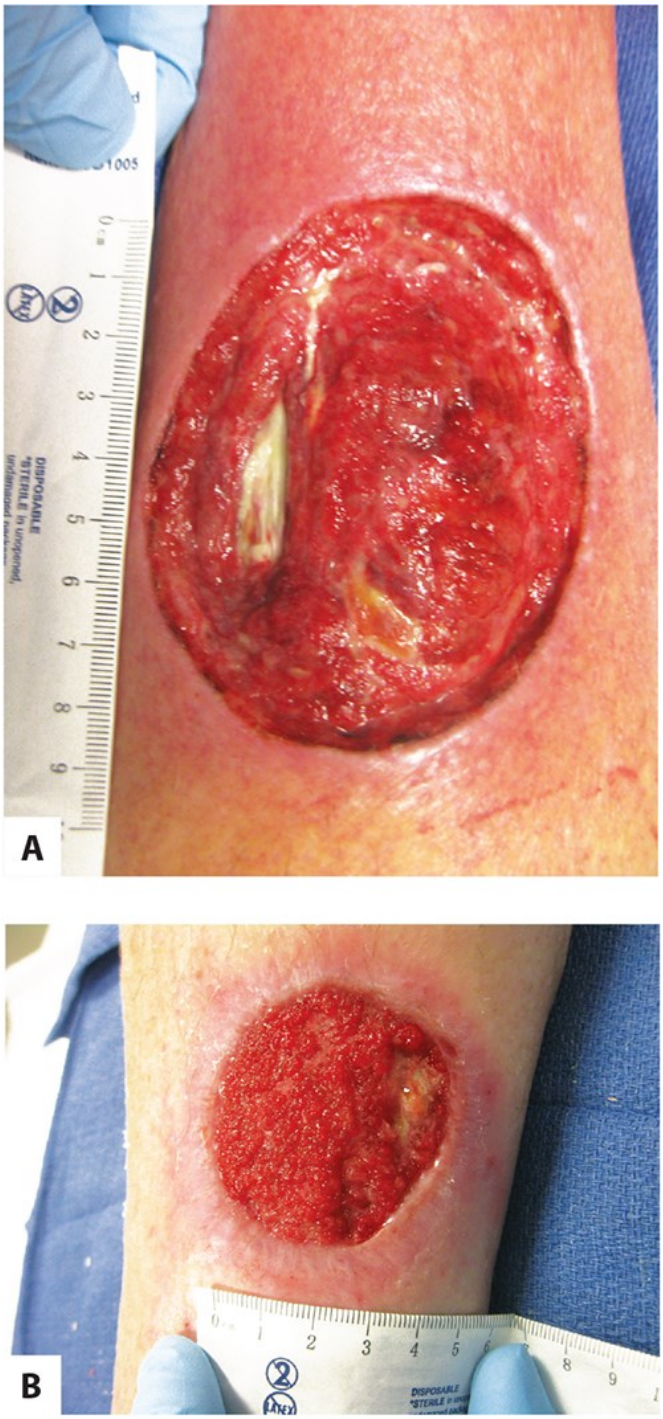
Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Granulation tissue, the hallmark of the proliferative healing phase, is composed of extracellular matrix and capillaries. It is the tissue that the body produces to fill in a wound cavity and to support new epithelial growth, and has, as its name suggests, a granular appearance. Note that not all red tissue is granulation tissue; for example, immediately after surgery muscle and subcutaneous tissue may also be red but have a different texture. For this reason, describing wounds by color only (as is sometimes discussed in the literature) may be misleading in the documentation (**FIGURE 3-18A, B**).

FIGURE 3-18

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Granulation tissue Granulation tissue is composed of new capillaries in an extracellular matrix and has a granular, beefy red appearance, as seen in photo **B**. The subcutaneous tissue in photo **A** is also red, but has a different texture, indicating that it is not fully granulated. Photo **A** is transitioning from inflammation to proliferation; photo **B** is in the proliferative phase.



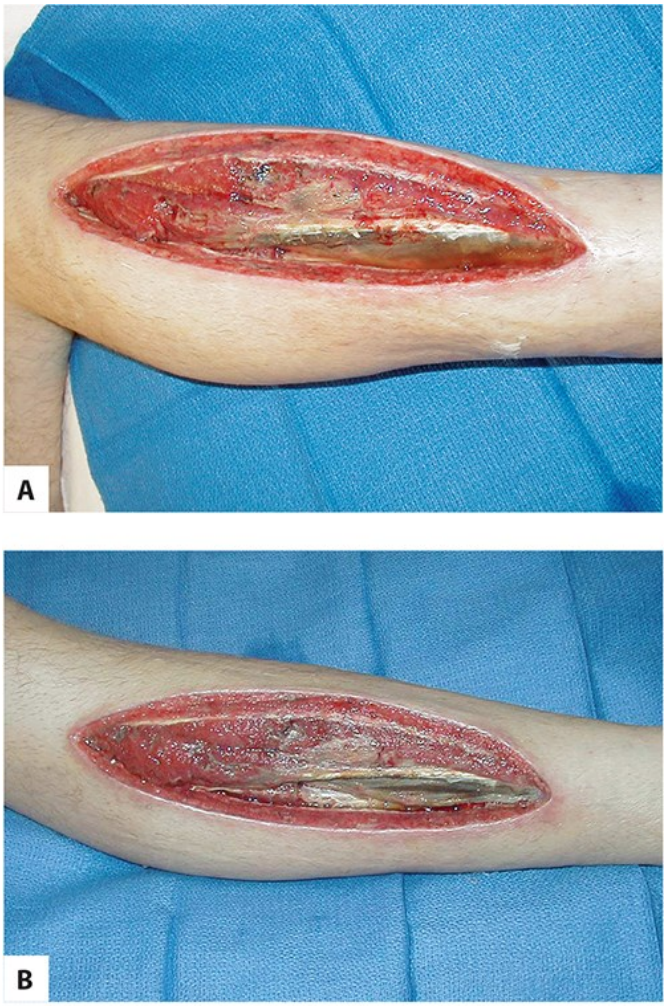
Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Muscle is identified by its location, its striated appearance, and its ability to contract with voluntary movement. In addition, healthy muscle bleeds when cut, is sensate and thus painful with stimulation, and is red. Conversely, unhealthy muscle is gray or brown, is insensate and therefore painless, does not bleed when cut, and has no contractibility (**FIGURE 3-19**).

FIGURE 3-19

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Unhealthy or non-viable muscle A. Unhealthy or non-viable muscle is dull gray or brown, is insensate and therefore does not cause pain when touched, does not bleed when cut, and does not twitch or respond to tactile stimulation. In addition, if the patient is asked to perform a joint movement, the non-viable muscle will not contract. Surgical removal is usually required for wound healing to progress. Non-viable muscle is observed in this fasciotomy wound at the time of initial evaluation. **B.** Three days later, the wound has started to granulate; however, non-viable muscle is still visible and requires further surgical debridement.



Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Bone is identified by its location and its hard texture when probed with a metal instrument. The color is tan when healthy, and darker brown or black when necrotic. Usually bone is covered by periosteum, the bi-layer covering (composed of collagen and fibroblasts) of almost all bone, which contributes to bone repair and nutrition (**FIGURE 3-20**).[35] Because of its importance in maintaining viability of the bone underneath, the periosteum should be kept moist and protected at all times. Necrotic bone usually requires surgical debridement; however, small, loose bone fragments may be removed during sharp debridement (**FIGURE 3-21**).

FIGURE 3-20

Viable bone Viable bone covered with periosteum and fascia is observed in the foot where the great toe has been amputated, leaving the second metatarsal head exposed.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

FIGURE 3-21

Non-viable bone Non-viable bone in a lower leg that has been treated with radiation for a malignant tumor. Granulation tissue (seen at the tips of the white arrows) will sometimes push through the cortical bone from the underlying trabecular bone; however, the necrotic bone usually has to be resected for the wound to heal.

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Tendons are readily observed in full-thickness wounds of the dorsal feet and hands where there is less subcutaneous tissue between the skin and the tendons. An important component of healthy tendons is paratenon, the fatty synovial fluid that fills the sheath around the tendon and thereby provides moisture, nutrients, and glidability. The healthy tendon sheath requires a moist dressing to prevent dessication, defined as destruction by drying out (**FIGURE 3-22**). Non-viable tendon requires debridement for full wound healing to occur and is usually performed in surgery. However, sometimes fiber by fiber debridement in a chronic full-thickness wound is advisable. In this case, if the tissue surrounding the tendon is viable, granulation tissue will penetrate the tendon and support re-epithelialization (**FIGURE 3-23**).

FIGURE 3-22

Viable tendon The extensor tendon with an intact paratenon is observed in the great toe after a bunionectomy incision dehisced.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

FIGURE 3-23

Non-viable tendon The Achilles tendon in the heel has lost its paratenon sheath and thus is stringy and dull. Selective debridement of the non-viable fibers will allow the granulation tissue to advance over the wound and in some cases will allow the wound to re-epithelialize. Loss of function depends on the amount of tendon that is lost.

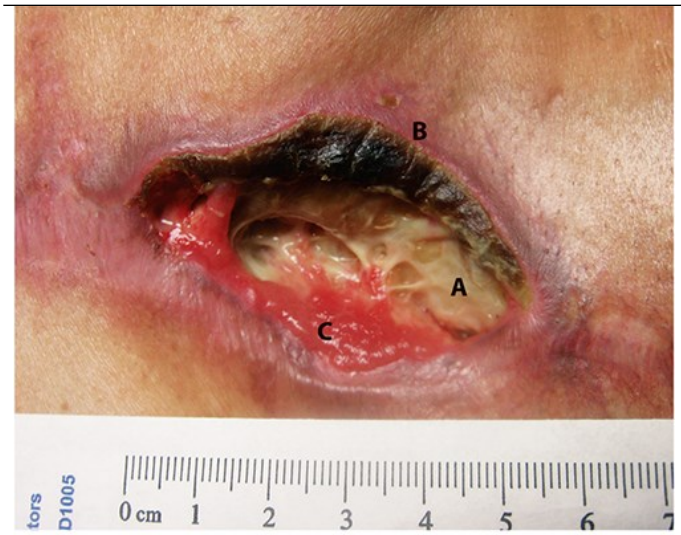
Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Adipose (fat) tissue appears as shiny globules when viable, and shriveled darker yellow tissue when non-viable. Because of its poor vascularity, adipose easily becomes non-viable and infected and is very slow to vascularize and granulate. This can become very problematic in obese patients who have non-healing abdominal surgical incisions (**FIGURE 3-24**).

FIGURE 3-24

Adipose in an abdominal wound Three distinct tissue types are observed in this abdominal wound: (**A**) shriveled yellow adipose, (**B**) dry black eschar, and (**C**) red granulation tissue.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

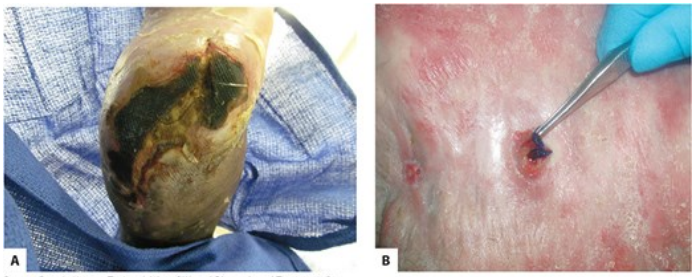


Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Foreign objects are sometimes visible within the wound bed (eg, sutures, staples, dressing remnants, splinters, or shards of glass after trauma). If a foreign object remains in the subcutaneous tissue and the skin grows over it, a granuloma may form and cause a small reopening due to the exudate that develops as the body tries to autolyse the object. Persistent drainage from an otherwise closed wound is a red flag for a foreign object in the subcutaneous tissue. These objects are evaluated for the best method of removal (ie, sharp versus surgical debridement), as well as for signs of infection (**FIGURE 3-25A, B**).

FIGURE 3-25

Foreign objects A. Both the suture and the eschar on the heel wound are perceived as foreign objects by the body and need to be removed for the wound to progress. **B.** The deep suture extruding from the last area of a dehisced abdominal wound will keep the wound from fully re-epithelializing unless it is removed.



Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Drainage

Drainage, or lack of it, provides valuable information about the wound status in terms of healing phase, infection, and other factors that may be inhibiting wound healing. In addition to identification of the drainage type, the amount is also documented and becomes an outcome measure as it decreases in amount and improves in quality. While terms like *scant*, *minimum*, *moderate*, *heavy*, and *copious* have been used to describe the amount of drainage, no definitions have been established for these terms. The author suggests that the definitions in **TABLE 3-7** may be helpful for the clinician in describing the amount of drainage observed during the assessment.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

TABLE 3-7

Definitions of Terms Used to Describe Amount of Drainage

Term	Description Based on Observation at Dressing Removal
Scant	Barely any drainage visible on the side of the dressing next to the wound; none visible after dressing removal.
Minimum	Drainage visible on the inner side of the dressing only; may be some visible on the wound bed after dressing removal; no new drainage expressed during treatment.
Moderate	Drainage visible on the inner side and small amount on the outer side of the dressing; some drainage visible on the wound bed after dressing removal; some drainage occurring during prolonged treatments.
Heavy	Drainage visible on both the inner side and outer side of the dressing; drainage visible immediately after dressing removal and after wound cleansing; may continue throughout the treatment.
Copious	Drainage not contained by a dressing deemed appropriate for the wound; drainage continues throughout the treatment requiring continuous cleansing, suctioning, or, in the case of bleeding, pressure or thrombotic applications.

Serous drainage is clear watery serum that normally appears during the inflammatory phase of acute wound healing and diminishes as healing progresses. It contains proteins but has no evident red blood cells or cellular debris to give it color. Common examples are the clear fluid in a blister and the drainage from an edematous extremity (**FIGURE 3-26**).

FIGURE 3-26

Serous drainage Clear serous fluid is draining from the wounds on the lower leg.

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Sanguineous drainage is thin blood that drains from a surgical or acute traumatic wound, or from the wound tissue (eg, subcutaneous or granulation) of a patient who is prone to bleeding because of medications (eg, anticoagulants) or low platelet count. Excessive bleeding slows down the healing process because of the loss of platelets, growth factors, and other cells required for the healing cascade to progress. Bleeding that clots within the wound bed is termed *coagulum* (**FIGURE 3-27A, B**).

FIGURE 3-27

Sanguineous drainage A. Sanguineous drainage is simply a medical term for bleeding, as is seen in the groin wound. It may be the result of a severed vessel, low platelets, or anticoagulation medication. **B.** A large amount of coagulum has collected in the base of the recent transmetatarsal amputation. Coagulum is removed cautiously as it may be serving as a clot to prevent further bleeding; if no new bleeding is occurring under the coagulum, it is removed to allow the healing process to progress.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Serosanguineous drainage is pink serous drainage because of the presence of a few red blood cells in the fluid (**FIGURE 3-28**).

FIGURE 3-28

Serosanguineous drainage Serosanguineous drainage is flowing from the pinpoint opening in an otherwise closed surgical incision, indicating a subcutaneous seroma or a small granuloma around an undissolved suture. Usually this type of wound needs to be opened, irrigated, and any foreign or necrotic tissue removed, a procedure termed *incision and drainage (I&D)*.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Exudate is pale yellow drainage composed of serum, dead cells, and lysed debris with a high protein concentration (specific gravity >1.015).[36] It is usually present in the inflammatory phase as the body autolyses the dead cells that result from the injury. *Transudate* is serous drainage that has a low protein concentration (specific gravity <1.015) (**FIGURE 3-29**).

FIGURE 3-29

Exudate The yellow drainage termed *exudate* can be seen on the right side of the heel wound. Because of the high protein content, the drainage sometimes coagulates on the surface of the wound and is referred to as *pseudoeschar* or *gelatinous edema*.

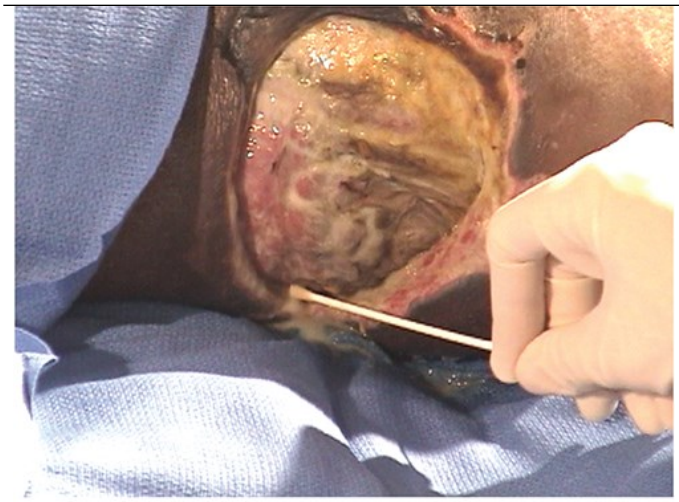
Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Purulence is thick, often odiferous, drainage that contains a large amount of lysed debris and bacteria. Commonly called *pus*, it indicates that a wound is critically colonized or infected (**FIGURE 3-30**). *Seropurulence* is slightly thicker yellow drainage that results when the body is destroying bacteria that may be in the wound.

FIGURE 3-30

Purulence Thick, odiferous drainage is flowing from the bottom of the wound bed where the applicator tip has probed a deep abscess.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility



Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Lymphatic drainage is serous drainage that has a high concentration of protein and fat molecules that are too large to be resorbed by the capillaries; it is frequently seen in wounds that are in close proximity to lymph nodes (eg, the groin) or in wounds that are on extremities with lymphedema (**FIGURE 3-31**).

FIGURE 3-31

Lymphatic drainage Clear lymphatic fluid is frequently seen in groin wounds when the lymph vessels have been severed and flow through the lymph nodes is interrupted. The fluid can be seen collecting at the upper edge of the wound.

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Chylous drainage occurs after abdominal surgeries, especially retroperitoneal ones, where there is trauma to the cisterna chyli or adjacent lymphatic trunks. The lymphatic system carries fluid with fat and protein molecules too large to return via the venous system; therefore, the chylous drainage that leaks from the wound is rich in triglycerides, giving it a thick, white, milky consistency (**FIGURE 3-32**).[37] The lymphatic system, its functions, and disorders are discussed in detail in Chapter 6, Pressure Injuries.

FIGURE 3-32

Chyle Chylous fluid is draining from the abdominal wound of a patient who had gastric bypass surgery. The thick, milky white fluid may be mistaken for purulence; however, it is the high emulsified fat content in the abdominal lymphatic fluid that gives chyle its appearance.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Infected drainage, in addition to being thick and opaque, may have a greenish tint with a distinct odor, indicative of a *Pseudomonas* infection (**FIGURE 3-33**).

FIGURE 3-33

Drainage with *Pseudomonas* infection The green tint to the slough in this lower extremity wound indicates a high probability of the presence of *Pseudomonas*, either critical contamination or infection. It may also be accompanied by a sweet smell that is characteristic of the *Pseudomonas* microbe.

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Enterocutaneous or *enteroatmospheric fistula drainage* can vary from thin and watery to thick and formed, from green bilious to brown fecal matter, and from no odor to strong odor, all depending on the location of the fistula. If drainage is suspected to be from a new fistula, the referring physician should be notified immediately (**FIGURE 3-34**).

FIGURE 3-34

Fistula drainage The thin watery brown drainage seen in the periphery of this abdominal wound is from a fistula located in the deep area at the wound periphery, termed *gutter*. Thin, sometimes green, drainage is usually from the more proximal intestine, whereas brown and thicker contents are usually from the more distal or large bowel.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Periwound Skin

Careful examination of the periwound skin may provide clues to the wound etiology, the extent of tissue damage, and tissue vascularity for healing. Characteristics that are notable include color, temperature, and texture, all of which are compared to an uninvolved area of the body or extremity for significant changes. Color and texture are illustrated in the photographs. Temperature differences can be palpable with the examiner's hand, or can be objectively measured with an infrared skin thermometer, thermistor, skin thermometer strips, infrared camera,[38] or thermogram.[22]

Normal skin temperature on the trunk is between 92°F and 96°F; on the extremities, between 75°F and 80°F.[22] Studies have indicated that 33°C is the critical level required for normal cellular activity.[39] A difference (increase) of 3 degrees or more indicates presence of pathology (eg, inflammation secondary to deep tissue injury, infection in the wound or periwound tissue, or acute Charcot foot fracture).[3,38–43] A decrease in skin temperature is usually suggestive of arterial insufficiency that has become ischemia. Possible diagnoses include severe peripheral vascular disease with arterial occlusion, embolic occlusion, compartment syndrome, or severe hypotension.

Erythema is defined as redness of the skin and can be caused by a multitude of conditions. It may be further defined as blanchable (meaning it turns white with pressure and recovers within seconds) or non-blanchable. Examples include inflammation, infection, Stage I pressure ulcer, allergic reaction, sunburn, frostbite, or reactive hyperemia (increased blood supply to an area that occurs after the blood supply has been absent and is then restored, eg, after revascularization surgery) (**FIGURES 3-35** to **3-38**). As with all abnormal characteristics, determining the cause of erythema is a necessary precedent to treatment.

FIGURE 3-35

Cellulitis The erythema on the bilateral lower extremities is a result of cellulitis, a frequent complication of chronic edema or lymphedema.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

FIGURE 3-36

Infection The erythema and edema surrounding the pressure ulcer on the heel indicate there is deep infection. Other signs to note are warmth, pain with weight-bearing, and drainage from the wound. For diabetic foot ulcers, erythema that extends more than 2 cm from the edge of the wound is highly correlated with infection. If the wound can be probed to bone, there is a strong probability of osteomyelitis, or infection of the underlying bone.[44]

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

FIGURE 3-37

Excoriation The erythema on the sacral/perianal skin is a result of excoriation, or loss of the epidermis, from moisture and friction.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

FIGURE 3-38

Inflammation The erythema in this lower extremity wound is an inflammatory response to an acute injury, a pathogen, or a vasculitic disorder. A tissue biopsy has been performed (note the suture site) to help determine the underlying pathology.

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Cyanosis is a blue-to-purple discoloration indicating lack of blood flow to the area. Initially it may be termed *dusky*, a visible early sign of hypoxia. Cyanosis usually occurs in the distal extremities as a result of severe peripheral vascular disease, emboli, or Raynaud's syndrome (**FIGURE 3-39**).

FIGURE 3-39

Cyanosis Several degrees of hypoxia can be distinguished on the foot with severe peripheral arterial disease—the red mottled appearance on the plantar medial foot, the purple on the lateral aspect of the fourth toe, and the almost black area on the medial plantar surface of the fourth toe. The blanched white skin on the plantar foot is an additional indication of lack of blood flow to the foot.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Dark red discoloration is a result of capillary bleeding that occurs in the deep tissue as a result of bone shearing on the adjacent soft tissue. Suspected deep tissue injury (see Chapter 6) and pre-ulcerative lesions on the diabetic foot are two examples where this type of discoloration is observed (**FIGURE 3-40**).

FIGURE 3-40

Dark red discoloration on plantar foot The dark discoloration on the plantar surface of a diabetic foot, while not specifically termed deep tissue injury, is from the same mechanical force—shearing of the bone against the adjacent subcutaneous tissue causing capillary destruction and deposition of red blood cells in the epidermis. If the cause (usually poorly fitting shoes) is not removed, the tissue damage will lead to full-thickness ulceration.

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Hemosiderous staining is a brownish-purple discoloration most frequently seen in patients with chronic venous insufficiency. Red blood cells are trapped in the interstitial congestion, and when they die by apoptosis, the body lyses the dead cells and the hemoglobin attached to them. The by-products of this autolytic process migrate to the superficial cutaneous layers and cause the discoloration (**FIGURE 3-41**).

FIGURE 3-41

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

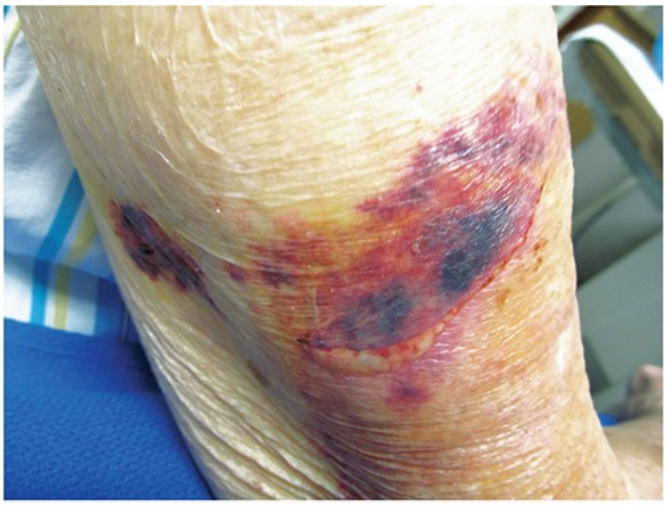
Hemosiderin staining The dark staining in the skin of a patient with chronic venous insufficiency is a result of the autolysis of hemoglobin in the dead red blood cells that migrate to the dermis/epidermis. Other signs of venous insufficiency are the bark-like texture of the skin, the thick scaling of the epidermis, and the location of the wound above the ankle.

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Ecchymosis or bruising is a result of deep tissue trauma that causes hemorrhaging of the blood vessels, resulting in dark-red-to-blue discoloration that goes through a sequence of colors (bluish-red to green to yellow) as it heals (**FIGURE 3-42**).

FIGURE 3-42

Ecchymosis Ecchymosis or bruising is visible around the skin tear on the lower extremity as a result of acute trauma.



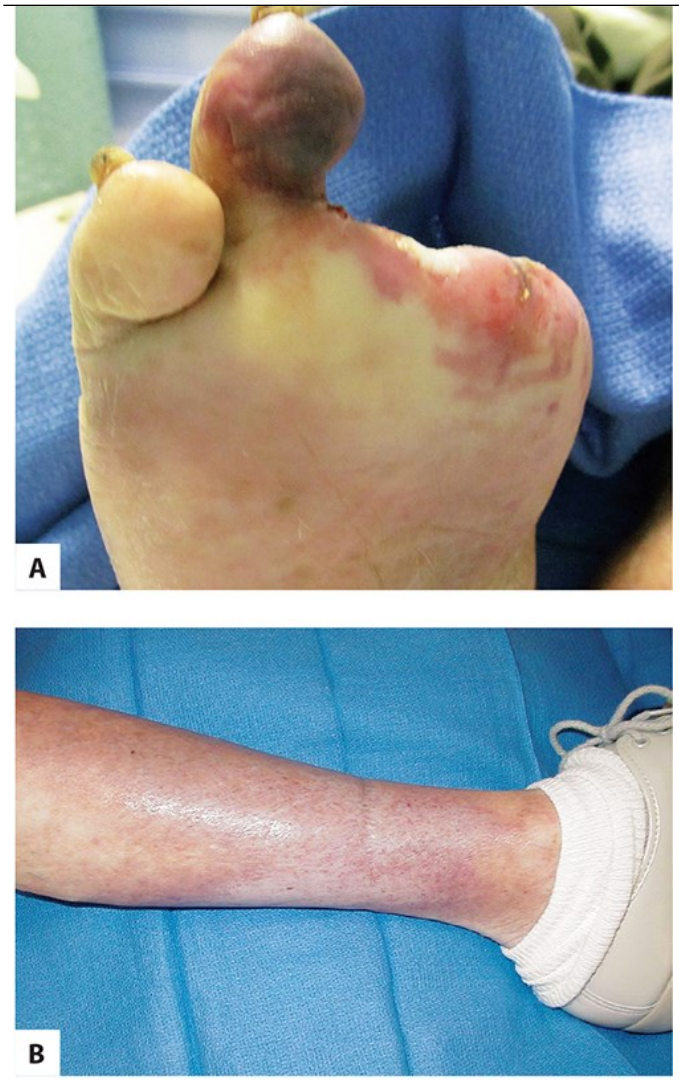
Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Blanched or white skin relative to the person's natural color is a result of decreased blood supply to the skin and may be a sign of underlying infection or a result of chronic venous insufficiency. In the latter case, it is termed *atrophie blanche* (**FIGURE 3-43A, B**).

FIGURE 3-43

Blanched skin A. The yellowish-white area over the 2nd, 3rd, and 4th plantar metatarsal heads is a common indication of underlying infection. The fluid may also cause the skin to be boggy, or there may be fluctuance in the subcutaneous tissue. **B.** Atrophie blanche, a sign of chronic venous insufficiency, is a result of decreased blood flow to the skin due to the venous interstitial congestion. The white area of atrophie blanche is visible on the posterior aspect of the lower extremity gaiter area.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility



Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Jaundice (or yellow skin, sclerae, mucous membranes, and excretions including wound drainage) is a result of hyperbilirubinemia and may be associated with a variety of disorders such as cirrhosis, hepatitis, obstruction of the bile duct, or hemolytic blood transfusion reaction (**FIGURE 3-44**).[45] Hyperbilirubinemia can also occur in infants who have either overproduction of bilirubin or a reduction in glucuronide conjugation in the liver.

FIGURE 3-44

Jaundice The yellow, or jaundiced, skin on this patient who has recently received a liver transplant is typical of hyperbilirubinemia associated with liver failure.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Changes in skin texture include a thin, shiny appearance with no hair (a result of peripheral arterial disease); thick, rough with thick scales (a result of chronic venous insufficiency); or orange peel texture, also called *peau d'orange* (a result of chronic edema). The skin may also become indurated, meaning the subcutaneous tissue is hard and firm (also a result of chronic edema, eg, with lymphedema) with fibrosis of the underlying connective tissue (**FIGURES 3-45** to **3-48**).

FIGURE 3-45

Skin changes with arterial disease The foot on the patient with severe peripheral arterial disease shows several signs of poor circulation—no hair growth on the toes; thick nails with probable fungus, termed *onychomycosis*; dry gangrene of the second toe; and dry, cracking skin. Vascular screening would probably reveal nonpalpable pulses and weak or absent Doppler signals of the dorsalis pedis and posterior tibial arteries.

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

FIGURE 3-46

Venous scales The thick epidermal scales on the lower leg are a common sign of chronic venous insufficiency.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

FIGURE 3-47

Texture changes Several signs of chronic venous insufficiency (besides the typical serpentine wounds) are the orange peel texture of the skin, the hemosiderin stains, and the thick bark-like skin.

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

FIGURE 3-48

Induration The hard, discolored area around the wound is termed *induration*, a sign of severe edema and fibrosis of the subcutaneous tissue. Again, note the orange peel texture and hemosiderosis.

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Edema

Edema results from abnormal amounts of water in the subcutaneous or interstitial tissue. When observed during an evaluation, further exploration of patient history, systems review, medications, and other symptoms is used to determine the cause of the edema. Again, the question, *why?,* has to be answered. Causes, measurement, and diagnosis of edema are discussed at length in Chapter 5, Lymphedema. Examples of edema associated with wounds are shown in **FIGURES 3-49** to **3-52**. Note that sudden onset of edema in one extremity, edema associated with pain, or edema associated with any other cardiovascular symptoms require that the patient be seen by a medical specialist on an emergent basis.

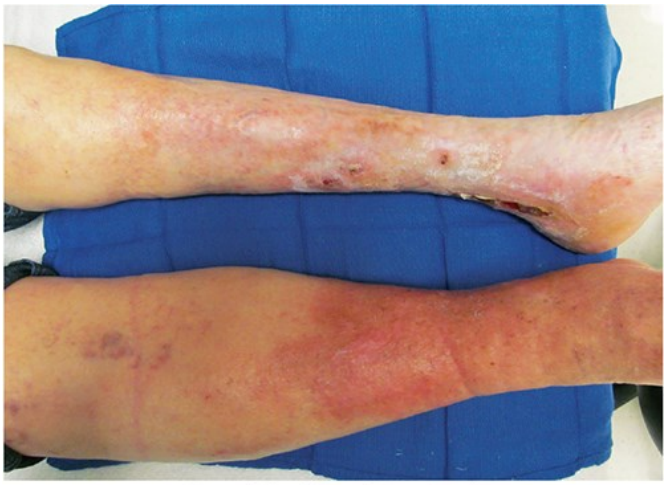
FIGURE 3-49

Edema due to chronic venous insufficiency The most common cause of lower extremity edema is chronic venous insufficiency, and it is usually associated with other signs and symptoms such as hemosiderosis, thick scaly skin, open wounds, complaints of heavy aching feelings, and frequent cellulitis.

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

FIGURE 3-50

Edema due to obstruction Sudden onset of edema that does not respond to standard therapy (ie, compression) is indicative of an obstruction proximal to the area that is edematous. This patient developed sudden onset of right lower extremity that extended to the groin, while she was being treated for the left lower extremity venous wound. The etiology of the right lower extremity edema was a rare malignancy that caused obstruction of the pelvic and abdominal lymph nodes.



Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

FIGURE 3-51

Edema due to trauma A fall caused the severe hematoma and surrounding local edema on the calf as well as the distal pedal edema and ecchymosis.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

FIGURE 3-52

Edema due to systemic disorders Edema secondary to systemic disease is usually bilateral and may not have the skin changes seen with chronic venous insufficiency. The ridges visible on the skin are commonly seen after removal of bandages as a result of the decrease in the fluid content of the subcutaneous tissue. It is a positive indication that the compression is effective.

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Wound Edges

Observing what is happening at the wound edges can provide information on the cause of the wound as well as the healing potential. As the wound goes through the proliferative phase, careful attention to the edges will also facilitate wound re-epithelialization.

Even edges are usually a result of ischemia to the skin, as in peripheral arterial disease, which causes the wound to have a “punched out” appearance. Other causes of hypoxia that may result in even edges include poor cardiac output and anemia due to other underlying disorders (eg, a gastrointestinal bleed or sickle cell anemia). In any of these cases, treatment of the underlying pathology is a must in order for wound healing to occur (**FIGURES 3-53** and **3-54**).

FIGURE 3-53

Even edges Arterial wounds usually have even edges, giving them a punched-out effect. The granulation, if any, is of poor quality, and other signs of arterial insufficiency are usually present. A second wound is barely visible on the medial aspect of the 2nd toe, illustrating the necessity of doing a good interdigital examination when assessing the foot.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

FIGURE 3-54

Even edges due to cardiac disease Wounds on the lower extremity may appear to be arterial or venous and still not respond to standard care. The patient cardiac status, eg, output and ejection fraction, may be insufficient for good perfusion of the distal lower extremity, giving the wound arterial characteristics, even if it is at an unusual location, as seen in this patient with a wound on the malleolus. The cause of the wound is probably pressure, with failure to heal because of cardiac disease.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Uneven edges, also referred to as *serpentine*, are typically seen in wounds caused by chronic venous insufficiency (**FIGURE 3-55**).

FIGURE 3-55

Uneven edges Uneven or serpentine edges are typical of wounds caused by venous insufficiency. Other signs seen on this lower extremity wound that suggest venous disease include the hemosiderin stains and edema.

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

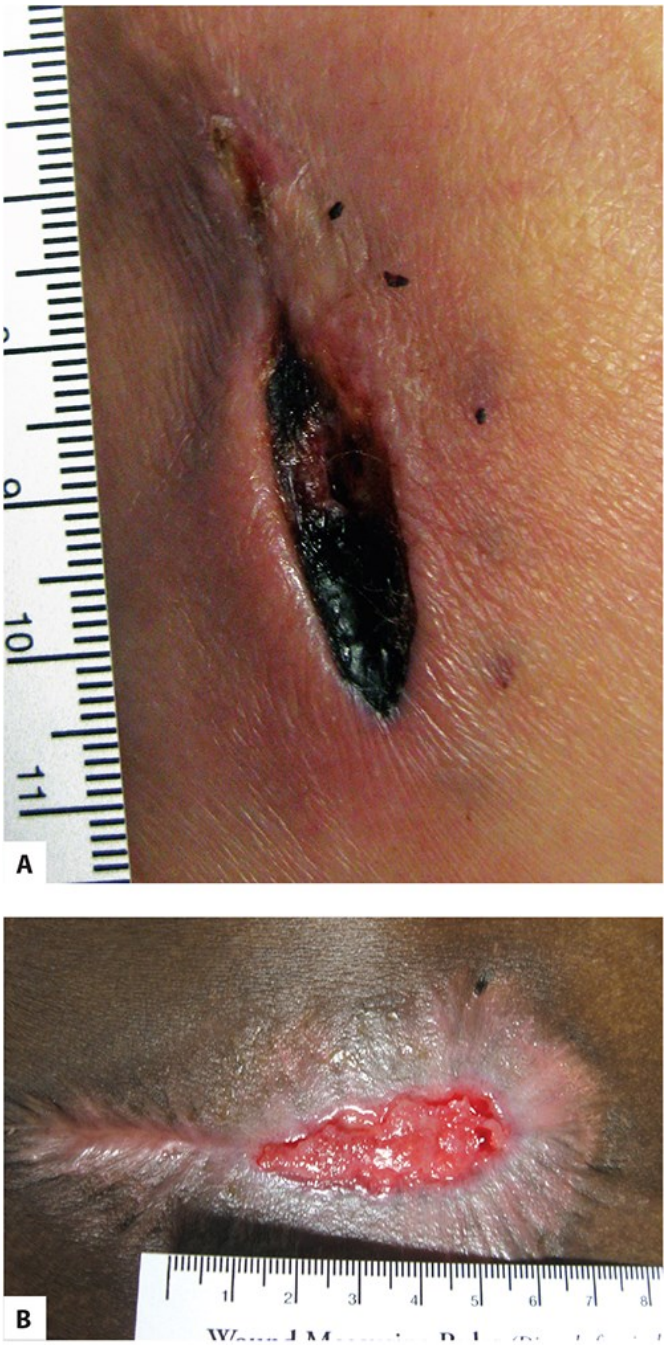
Rolled edges occur when the epithelial cells at the edge are unable to migrate across the wound bed. This may be a result of an unhealthy wound bed, inability to produce the basement membrane that the epithelial cells adhere to, or a condition termed *epibole* in which the upper epidermal cells roll down over the lower epidermal cells and prevent epithelial migration across the wound bed. The exact mechanism for the inability of keratinocytes to respond to signaling pathways that stimulate them to migrate across the wound surface is not fully understood; however, the abnormal keratinocytes must be removed, unresponsive keratinocytes must be stimulated, and/or exogenous keratinocytes must be provided to stimulate the non-healing wound. Re-epithelialization can be stimulated by several treatment interventions, including

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

advanced dressings and biophysical agents (eg, electrical stimulation, therapeutic ultrasound, negative pressure wound therapy, and hyperbaric oxygen therapy) (**FIGURE 3-56A, B**).[46,47]

FIGURE 3-56

A. Rolled edges Rolled edges are usually adhered to the adjacent tissue and must be debrided in order for the granulation tissue and healthy epithelial cells to progress to re-epithelialization of the wound bed. **B. Epibole** Epibole occurs when the epidermal cells roll down over the lower epidermal cells, thereby preventing the progression of epithelial migration across the wound bed, as seen at the upper edge of this wound. Unlike the wound in **FIGURE 3-56A**, where the rolled edges attach to necrotic tissue, the epidermal cells of epibole usually are adjacent to granulation tissue.



Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Detached edges are a sign of undermining, wound regression possibly due to bacteria load, or premature epithelial migration (**FIGURE 3-57**).

FIGURE 3-57

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

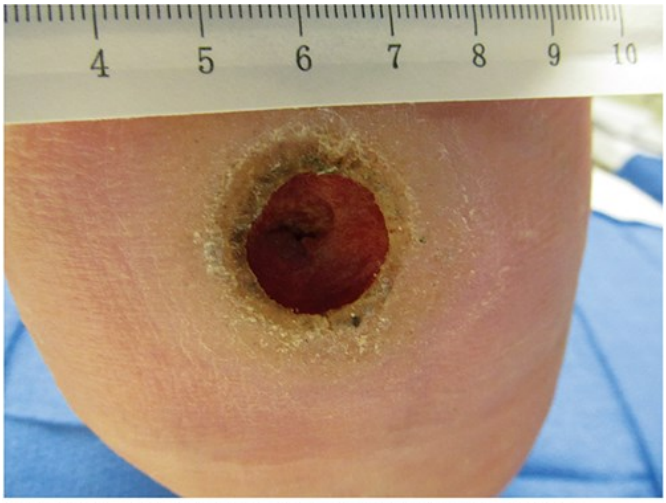
Detached edges The dark shadowing at the wound edges indicates that the epithelium is detached from the underlying subcutaneous tissue.

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Hyperkeratosis, or *callus*, is a result of overproduction of the stratum corneum or outer layer of the epidermis, usually as a result of repeated friction from shoes or some other device. It is most frequently observed on the foot from poorly fitting shoes or on the hands from mechanical labor, especially on an insensate foot or hand (**FIGURE 3-58**).

FIGURE 3-58

Hyperkeratosis Hyperkeratosis, or overdevelopment of the stratum corneum, is common at wound edges where friction is a contributing factor, eg, on the plantar surface of the diabetic foot. Hyperkeratosis is composed of dead cells and must be debrided in order for healing to progress.



Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Epithelialization, the goal of every wound care intervention, is a sign that the wound is entering the final stages of the proliferative healing phase. Sometimes the preceding basement membrane can be observed on the edge of the granulation tissue, appearing as a thin clear film (**FIGURE 3-59**).

FIGURE 3-59

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Epithelial migration Migration of the epithelial cells across a healthy granulated wound bed is preceded by the formation of basement membrane or a thin layer of fibronectin that serves as the glue for the epithelial cells. Re-epithelialization occurs at the wound margins or at the hair follicles and sweat glands in partial thickness wounds, as indicated by the islands of new skin growth seen scattered throughout the wound bed.

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

Wound Odor

Wound odor can be a detective signal and something the evaluator learns to recognize. Almost all wounds will have some odor with dressing removal as a result of the interaction between the drainage, the wound, and the dressing; however, the odor to be concerned about is that which persists after the wound has been thoroughly cleaned. Following are some verbal descriptions of what one might smell.

Pseudomonas has a distinctive sweet odor and usually accompanies drainage that has a greenish tint. *Infection* has a putrid smell, and *necrotic* tissue has a unique "dead" odor. *Malignant* tissue can have a musky odor similar to wet cardboard. Sometimes an odor will indicate what type of dressing or topical agent the patient has been putting on the wound (eg, Dakins solution will smell like bleach, acetic acid will smell like vinegar, and dressings with iodine will smell like just that—iodine). If odor is present, lack of odor can be an appropriate initial goal.

Infection

Signs of infection are listed in **TABLE 3-8**; however, some of the same signs are indicative of inflammation. One distinct difference is that inflammation does not usually have the same odor that accompanies infection because the number of bacteria is less. If there are sufficient signs to suggest infection, and certainly if there are systemic signs of infection such as fever (more than 100.4°F that does not decrease 1–2 days after surgery), malaise, elevated white count, or altered mental status, referral to a medical specialist for antibiotic therapy is indicated. Infection is discussed in more detail in Chapter 11.

TABLE 3-8

Signs of Infection

Erythema—usually darker than erythema seen in inflammation, distinct borders, may streak away from the wound
Pain—usually deep and described as throbbing
Edema—usually diffuse borders and localized to the wound site rather than full extremity edema observed with chronic venous insufficiency or lymphedema
Heat—usually can be palpated as warm periwound skin; may be measured with an infrared skin thermometer; a difference of 3°F is significant
Purulence—usually thick exudate that may or may not have an odor
Malaise—patient complains of feeling tired, lack of energy

Pain

Pain is often referred to as the fifth vital sign and is required documentation with any procedure, medication, or wound intervention. There are several useful tools available to help patients quantify pain (**TABLE 3-9**). However, in addition to the presence and intensity, it is imperative that the evaluator determine the *cause* of the pain. For example, if a patient with a cast on the lower leg complains of pain, asking the patient to describe the pain and to indicate exactly where the pain is felt will help to

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

rule out a poorly fitting cast that may be causing a wound on a bony prominence. **TABLE 3-10** provides some of the typical causes of different types of pain.

CASE STUDY

INTRODUCTION

Mr. MT is a 71-year-old male referred to the out-patient clinic with two wounds on the right lower leg as a result of fasciotomies. Medical history includes bladder cancer for which he had a radical cystectomy and neobladder performed 10 weeks prior to referral. Two days after surgery he developed right lower extremity compartment syndrome that required surgical release of the pressure with medial and lateral fasciotomies (**FIGURE 3-60** to **3-62**). The medial wound is 18 cm × 3 cm; the lateral wound is 16 cm × 1 cm. There is a moderate amount of sanguineous drainage on the old dressing but no active bleeding with dressing removal. There is no odor noted with dressing removal.

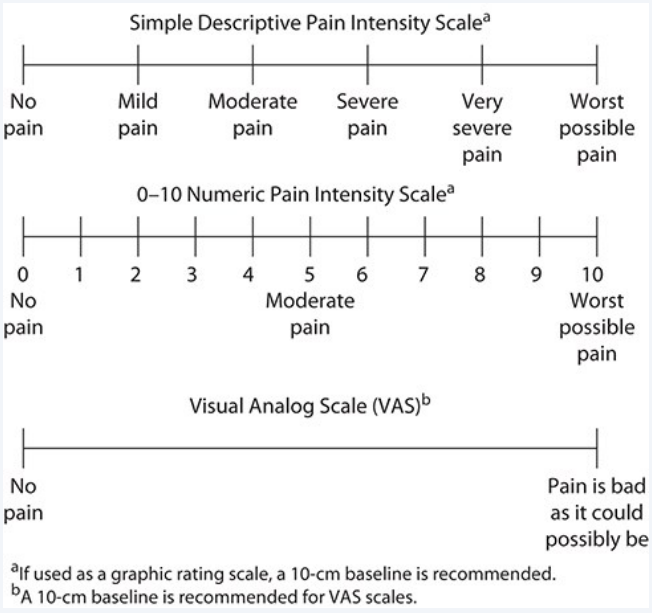
Other medical history includes coronary artery disease with coronary artery bypass graft one year ago, Type 2 diabetes, hypertension, insomnia, and recurrence of infections during recovery period. He lives with his wife in a two-storey home and works for the family business.

DISCUSSION QUESTIONS

1. What questions would be included in obtaining the subjective history?
2. Describe the wound characteristics visible in the photographs.
3. Using the information provided and the photos of the wounds, calculate the Bates-Jensen Wound Assessment Tool score for both the medial and lateral wounds.

TABLE 3-9

Visual Analog Scale


Simple Descriptive Pain Intensity Scale[a]
No pain
Mild pain
Moderate pain
Severe pain
Very severe pain
Worst possible pain
0–10 Numeric Pain Intensity Scale[a]
0 1 2 3 4 5 6 7 8 9 10
No pain
Moderate pain
Worst possible pain
Visual Analog Scale (VAS)[b]
No pain
Pain is bad as it could possibly be
[a]If used as a graphic rating scale, a 10-cm baseline is recommended.
[b]A 10-cm baseline is recommended for VAS scales.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140

©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

TABLE 3-10

Pain: Typical Descriptions and Causes

Pain Description	Possible Cause
Ache, heavy	Chronic venous insufficiency, edema
Burning	Friction, blisters, abrasion, neuropathy
Cramping	Intermittent claudication, hypoxia
Electric	Stimulation of exposed nerves
Sharp	Inflammation
Stinging	Reaction to topical dressing
Throbbing	Infection
Tingling	Neuropathy, too much pressure from compression

FIGURE 3-60

Right medial lower leg fasciotomy wound

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

FIGURE 3-61

Close-up view of the distal medial wound

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

FIGURE 3-62

Right lateral lower leg fasciotomy wound

Source: Rose L. Hamm: *Text and Atlas of Wound Diagnosis and Treatment*, 2e
Copyright © McGraw-Hill Education. All rights reserved.

REVIEW OF SYSTEMS

In addition to the detailed review of the integumentary system described for a patient with a wound, a review of the cardiovascular, neuromuscular, and musculoskeletal systems is a vital part of the complete assessment and can provide further insight into contributing factors leading to wound formation or delayed healing.

The basic assessment for any patient will be discussed here, and details specific to particular diagnoses will be discussed in the diagnostic chapters.

Cardiovascular/Pulmonary System

If cardiac output or pulmonary function is compromised, less oxygen delivery to the wounded tissue will result in delayed healing responses. Critical levels may need to be addressed by changes in medication, surgical intervention, or activity levels in order to facilitate the healing. Cardiopulmonary tests and measures recommended for cardiovascular patients include blood pressure, oxygen saturation levels, and respirations (both quantity and quality). Vascular screening includes peripheral pulses, capillary refill, and ankle-brachial index (if arterial insufficiency is detected). Other signs of vascular insufficiency to observe are thick nails with onychomycosis, lack of hair on the digits and lower leg, and thin shiny skin. Refer to Chapter 4, Vascular Wounds, for more details on the vascular assessment.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Musculoskeletal System

The musculoskeletal assessment includes range of motion, especially of the foot and ankle for patients with diabetic or venous wounds, the spine and hips for patients with pressure ulcers, and the upper extremities and hands for patients who need to use assistive devices for offloading or need to reposition for pressure redistribution. Strength measurements are taken to ensure adequate ability to use devices, to reposition, and to ambulate with a normal gait cycle. Anatomical deformities that may contribute to diabetic foot or pressure ulcer formation need to be noted and adaptations included in the plan of care. Strength and/or stretching exercises may be indicated to redistribute pressure, improve gait dynamics, or improve blood flow to specific areas. Muscular atrophy that increases the risk of pressure ulcer formation is assessed and is a prerequisite for selection of support surfaces to both prevent and treat pressure ulcers.

CASE STUDY

Cardiopulmonary review of Mr. MT revealed the following:

- *Vital signs:* blood pressure 135/70; heart rate 82; oxygen saturation 98% at rest.
- Shortness of breath with minimal exertion.
- Dorsalis pedis and posterior tibial pulses not palpable; positive Doppler signal.
- Capillary refill on the great toe: 4 seconds.
- Ankle-brachial index: 0.65.

Musculoskeletal review revealed the following:

- Range of motion is within normal limits except for the right ankle (0–15 degrees plantarflexion.
- Right ankle strength: 2/5, right knee and hip: 2+/5. Left lower extremity strength: grossly 3+/5; bilateral upper extremity strength: 4−/5.
- Edema in the right foot and lower leg, pitting in the foot only.
- Patient reports loss of weight (>30 pounds) during illness and daughter reports patient has poor appetite and does not want to eat.
- *Function:* Mod assist for bed mobility and supine to sit, min assist for transfers from wheelchair to bed.
- *Gait:* Ambulates 50 feet with front-wheel walker, close supervision; uses step-to gait sequence with poor awareness of right foot placement and partial weight-bearing on the right. Patient able to express his fear of falling.

In addition to individual muscles or muscle groups, overall muscle mass is observed for patients who may be either underweight or overweight, as both conditions can affect the ability to heal wounds. Body mass index (BMI) is the measurement used to assess muscle mass, and is defined by this equation:

BMI = weight (in kg)/height (in m^2) OR weight (in pounds)/height (in $in.^2$) × 705

A BMI of less than 19 may indicate malnutrition with a risk for protein energy malnutrition, and a BMI of more than 30 indicates obesity, which can also affect wound healing.[48] Loss of lean body mass (LBM) has also been shown to have deleterious effects on the body and on wound healing, and the following guidelines have been established:

- 10% loss of LBM—impaired immune system, increased risk of infection, protein still available for wound healing.
- 15% loss of LBM—weakness, increased risk of infection, wound healing rate decreases, new wounds develop.
- 20% loss of LBM—wound healing ceases, new wounds develop, skin becomes thinner because of collagen depletion.[49]

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

CASE STUDY

Neurologic review reveals the following:

- Alert and oriented ×4.
- Follows two-step commands.
- No response to 6.65 monofilament on the right foot; positive response to 5.07 monofilament on the left.
- Impaired proprioception of the right great toe and ankle.

Other pertinent information:

- Blood sugars range from 100 to 130 (per patient report).
- Pain levels are 2–4/10 with any tactile stimulation to the wound bed.
- Lifting is restricted to 5 pounds.
- Medications include Norvasc, Lipitor, Amaryl, sodium bicarbonate, Plavix, aspirin, Miralax, oxycodone, Neurontin, and Tylenol as needed.

DISCUSSION QUESTIONS

1. What factors can be identified that may interfere with this patient's wound healing?
2. What medication is he taking that may contribute to the sanguineous drainage from his wounds?
3. What impairments are contributing to his functional limitations? Do these have an impact on his wound healing and how?
4. Interventions will be discussed in later chapters; however, what goals would be appropriate for Mr. MT?

Protein energy malnutrition and its effect on wound healing are discussed in more detail in Chapter 11, Factors That Impede Wound Healing.

Neurologic System

Neurologic testing includes both central and peripheral nervous systems. The ability to comprehend and follow instructions is necessary for compliance with home instructions (eg, off-loading, exercise programs, diet, dressing changes), and for learning new tasks (eg, gait training or repositioning). Peripheral testing (including sensation, vibration, proprioception, pressure, and reflexes) is an integral part of the assessment of a patient with a pressure ulcer or a diabetic foot ulcer in order to determine if the patient has protective sensation and ability to feel the consequences when pressures are causing tissue damage.

SUMMARY

Evaluation of a patient with a wound is necessarily a time-consuming, meticulous process in order to determine why the patient has a wound, why it is not healing, and what the optimal evidence-based care plan should be in order to facilitate healing. Only when the *why* has been answered can complete healing and long-term prevention of recurrence be achieved. However, spending the time and effort with the patient initially and being thorough in all aspects of the evaluation will facilitate faster healing rates, prevent further patient discomfort and disability, save professional provider time, foster better patient compliance and trust in the clinician, and promote wise use of precious medical supplies and dollars in the overall course of treatment.

REFERENCES

1. Jones TR. Wound care. In: Stone CK, Humphries RL, eds. *CURRENT Diagnosis & Treatment Emergency Medicine.* 8th ed. New York, NY: McGraw-Hill; 2017. Available at: http://www.accessmedicine.com.ezproxy.cihe.edu.hk/content.aspx?aID=55752180. Accessed July 19, 2018.

2. Bates-Jensen BM. Pressure ulcers. In: Halter JB, Ouslander JG, Tinetti ME, Studenski S, High KP, Asthana S, eds. *Hazzard's Geriatric Medicine and Gerontology*. 7th ed. New York, NY: McGraw-Hill; 2017. Available at: http://www.accessmedicine.com.ezproxy.cihe.edu.hk/content.aspx?aID=5120633. Accessed July 19, 2018.

3. National Pressure Ulcer Advisory Panel. Pressure Ulcer Scale for Healing (PUSH). Available at: http://www.npuap.org. Accessed July 19, 2018.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

4. Hon J, Lagden K, McLaren AM, et al. A prospective, multicenter study to validate use of the Pressure Ulcer Scale for Healing (PUSH©) in patients with diabetic, venous, and pressure ulcers. *Ostomy Wound Manag*. 2010;56(2):26–36.

5. Choi PH, Chin WY, Wan EYF, Lam CLK. Evaluation of the internal and external responsiveness of the Pressure Ulcer Scale for Healing (PUSH) tool for assessing acute and chronic wounds. *J Adv Nurs*. 2016;72(5):1134–1143. [PubMed: 26750541]

6. Horn SD, Fife CE, Smout RJ, Barrett RS, Thomson B. Development of a wound healing index for patients with chronic wounds. *Wound Repair Regen*. 2013;21:823–832. [PubMed: 24134202]

7. Fife C, Horn S, Smout R, Barrett RS, Thomson B. A predictive model for diabetic foot ulcer outcome: The Wound Healing Index. *Adv Wound Care*. 2016;5(7):279–287.

8. Horn SD, Barrett RS, Fife CE, Thomson B. A predictive model for pressure ulcer outcome: The Wound Healing Index. *Adv Skin Wound Care*. 2015:28(12):560–572. [PubMed: 26562203]

9. Renner R, Erfurt-Berge C. Depression and quality of life in patients with chronic wounds: ways to measure their influence and their effect on daily life. *Chronic Wound Care Manag Res*. 2017;4:143–151. Available at: https://doi-org.ezproxy.cihe.edu.hk/10.2147/CWCMR.S124917. Accessed July 6, 2018.

10. Augustin M, Herberger K, Rusenbach SJ, Schafer I, Zschocke I, Blome C. Quality of life Evaluation in wounds: validation of the Freiburg Life Quality Assessment-wound module, a disease-specific instrument. *Int Wound J*. 2010;7(6):493–501. [PubMed: 20880326]

11. Augustin M, Debus ES, Bruning G, et al. Development and validation of a short version of the Freiburg Life Quality Assessment for chronic venous disease (FLQA-VS-10). *Wound Medicine*. 2015;8:31–35.

12. Augustin M, Montero EC, Zander N, et al. Validity and feasibility of the wound-QoL questionnaire on health-related quality of life in chronic wounds. *Wound Repair Regen*. 2017;25(5):852–857. [PubMed: 29080332]

13. Blome C, Baade K, Debus ES, Price P, Augustin M. The "Wound-QoL": a short questionnaire measuring quality of life in patients with chronic wounds based on three established disease-specific instruments. *Wound Repair Regen*. 2014;22(4):504–514. Available at: https://doi-org.ezproxy.cihe.edu.hk/10.1111/wrr.12193. Accessed July 6, 2018. [PubMed: 24899053]

14. Cardiff Wound Impact Schedule. Available at: http://www.southwesthealthline.ca/healthlibrary_docs/B.4.2.CardiffWoundImpactQuest.pdf. Accessed July 6, 2018.

15. Engelhardt M, Spech L, Diener H, Faller H, Augustin M, Debus ES. Validation of the disease-specific qualigy of life Wuerzburg Wound Score in patients with chronic leg ulcer. *Vasa*. 2014;43(5):372–379. [PubMed: 25147014]

16. Bates-Jensen BM, Sussman C. Tools to measure wound healing. In: Sussman C, Bates-Jensen B, eds. *Wound Care: A Collaborative Practice Manual for Health Professionals*. 4th ed. Baltimore, MD: Lippincott Williams & Wilkins; 2012:131–161.

17. Mortenson WB, Miller WC. SCIRE Research Team. A review of scales for assessing the risk of developing a pressure ulcer in individuals with SCI. *Spinal Cord*. 2008;46:168–175. Available at:http://www.nature.com/sc/journal/v46/n3/full/3102129a.html. July 19, 2018. [PubMed: 17909557]

18. Gunes UY. A prospective study evaluating the Pressure Ulcer Scale for Healing (PUSH Tool) to assess Stage II, Stage III, and Stage IV Pressure Ulcers. *Ostomy Wound Manage*. 2009;55(5):48–52. [PubMed: 19471048]

19. Mullins M, Thomason SS, Legro M. Monitoring pressure ulcer healing in persons with disabilities. *Rehabil Nurs*. 2005;30(3):92–99. [PubMed: 15912673]

20. Greatrex-White S, Moxey H. Wound assessment tools and nurses' needs: an evaluation study. *Int Wound J*. 2015;12(3):293–301. [PubMed: 23711205]

21. Bolton LL. Benchmarking chronic wound healing outcomes. *Wounds*. 2012;24(1). Available at: http://www.medscape.com/viewarticle/758217_5. Accessed March 6, 2013.

22. Romanelli M, Dini V, Bertone MS, Brilli C. Measuring wound outcomes. *Wounds*. 2007;19(11):294–298. [PubMed: 25942592]

23. Sheehan P, Jones P, Giurini JM, Caselli A, Veves A. Percent change in wound area of diabetic foot ulcers over a 4-week period is a robust predictor of complete healing in a 12-week prospective trial. *Plast Reconstr Surg*. 2006;117(7 suppl):239S–244S. [PubMed: 16799391]

24. Wendland D, Taylor DWM. Wound measurement tools and techniques: a review. *J Acute Care Phys Ther*. 2017;8(2):42–57.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

25. Wendelken ME, Berg WT, Lichtenstein P, Markowitz L, Comfort C, Alvarez OM. Wounds measured from digital photographs using photodigital planimetry software. *Wounds*. 2011;23(9):267–275. [PubMed: 25879267]

26. Chang AC, Dearman B, Greenwood JE. A comparison of wound area measurement techniques: Visitrak vs photography. *Eplasty*. 2011;11:e18. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3080766/. Accessed July 8, 2018. [PubMed: 21559060]

27. Lampe KE. Assessing the patient: the general evaluation. In: McCulloch JM, Kloth LC, eds. *Wound Healing: Evidence Based Practice*. 4th ed. Philadelphia, PA: FA Davis; 2010:65–93.

28. Richard J, Daures J, Parer-Richard C, Vannereau D, Boulot I. Of mice and wounds: reproducibility and accuracy of a novel planimetry program for measuring wound area. *Wounds*. 2000;12(6). Available at: http://www.medscape.com/viewarticle/407562. Accessed July 19, 2018.

29. Gabison S, McGillivray C, Hitzig SL, Nussbaum E. A study of the utility and eequivalency of 2 methods of wound measurement: digitized tracing versus digital photography. *Adv Skin Wound Care*. 2015;28(6):252–258. [PubMed: 25988734]

30. Romanelli M, Kini V, Rogers LC, Hammond CE, Nixon MA. Clinical evaluation of a wound measurement and documentation system. *Wounds*. 2008;20(9):258–264. [PubMed: 25941848]

31. Yesiloglu N, Yildiz K, Akpinar AC, Gorfulu T, Sirinoglu H, Ozcan A. Histogram planimetry method for the measurement of irregular wounds. *Wounds*. 2016;28(9):328–333. [PubMed: 27701128]

32. Rogers LC, Bevilacqua NJ, Armstrong DG, Andros G. Digital planimetry results in more accurate wound measurements: a comparison to standard ruler measurements. *J Diabetes Sci Technol*. 2010;4(4):799–802. [PubMed: 20663440]

33. Gethin G. The importance of continuous wound measuring. *Wounds*. 2006;2(2):60–68.

34. Lipsky BA, Berendt AR, Cornia PB, Pile JC, Peters EJG, Armstrong DG, et al. Executive summary: 2012 Infectious Diseases Society of America Clinical Practice Guideline for the Diagnosis and Treatment of Diabetic Foot Infections. *Clin Infect Dis*. 2012;54(12):1679–1684. [PubMed: 22619239]

35. Mescher AL. Bone. In: Mescher AL, ed. *Junqueira's Basic Histology*. 12th ed. New York, NY: McGraw-Hill; 2010:121–139.

36. Fantone JC, Ward PA. Inflammation. In: Rubin E, Farber JL, eds. *Essential Pathology*. Philadelphia, PA: JB Lippincott; 1995:26.

37. Olthof E, Blankensteijn JD, Akkerskijk GJM. Chyloperitoneum following abdominal aortic surgery. *Vascular*. 2008;16(5):258–262. [PubMed: 19238866]

38. Dini V, Salvo P, Janowska A, Francesco FD, Barbini A, Romaelli M. Correlation between wound termperature obtained with an infrared camera and clinical Wound Bed Score in venous leg ulcers. *Wounds*. 2015;27(10):274–278. [PubMed: 26479211]

39. Armstrong DG, Lipsky BA, Polis AB, Abramson MA. Does dermal thermometry predict clinical outcome in diabetic foot infection? Analysis of data from the SIDESTEP trial. *Int Wound J*. 2006;3(4):302–307. [PubMed: 17199766]

40. Sussman C. Assessment of the patient, skin, and wound. In: Sussman C, Bates-Jensen B, eds. *Wound Care: A Collaborative Practice Manual for Health Professionals*. 4th ed. Baltimore, MD: Lippincott Williams & Wilkins; 2012:53–109.

41. Mufti A, Somayaji R, Coutts P, Sibbald RG. Infrared skin thermometry: validating and comparing techniques to detect periwound skin infection. *Adv Skin Wound Care*. 2018;31(1):607–617. [PubMed: 29240589]

42. Fierheller M, Sibbald RG. A clinical investigation into the relationship between increased periwound skin termperture and local wound infection in patients with chronic leg ulcers. *Adv Skin Wound Care*. 2010;23(8):367–379.

43. Houghton VJ, Bower VM, Chant DC. Is an increase in skin temperature predictive of neuropathic foot ulceration in people with diabetes? A systematic review and meta-analysis. *J Foot Ankle Res*. 2013;6(1):31. [PubMed: 23919736]

44. Lipsky BL. Infectious problems of the foot in diabetic patients. In: Bowker JH, Pfeifer MA, eds. *Levin and O'Neal's The Diabetic Foot*. 7th ed. Philadelphia, PA: Mosby/Elsevier; 2008:305–318.

45. Goodman CC. The hepatic, pancreatic, and biliary systems. In: Goodman CC, Fuller KS, Boisonnault WG, eds. *Pathology: Implications for the Physical Therapist*. Philadelphia, PA: Saunders; 2003:667–703.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

46. Woo K, Ayello EA, Sibbald RG. The edge effect: current therapeutic options to advance the wound edge. *Adv Skin Wound Care*. 2007;20(2):99–117. [PubMed: 17287621]

47. Luo S, Yufit T, Carson P, et al. Differential keratin expression during epiboly in a wound model of bioengineered skin and in human chronic wounds. *Int J Low Extrem Wounds*. 2011;10(3):122–129. [PubMed: 21856973]

48. Posthauer ME, Dorner B, Collins N. Nutrition: a critical component of wound healing. *Adv Skin Wound Care*. 2010;23(12):560–572. [PubMed: 21084879]

49. Litchford MD. Nutritional issues in the patient with diabetes and foot ulcers. In: Bowker JH, Pfeifer MA, eds. *Levin and O'Neal's The Diabetic Foot*. 7th ed. Philadelphia, MA: Mosby; 2008:199–217.

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Caritas Bianchi College of Careers
Access Provided by:
SILVERCHAIR INFORMATION/SYSTEMS

Downloaded 2022-3-23 7:48 A Your IP is 165.84.189.140
Chapter 3: Examination and Evaluation of the Patient with a Wound, Rose L. Hamm
©2022 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility